FINAL REPORT

ENERGY SAVINGS OPPORTUNITY SURVEY
U.S. ARMY FIELD STATION KUNIA
OAHU, HAWAII

PREPARED FOR:

Department of the Army
Pacific Ocean Division
Corps of Engineers

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LIST OF REFERENCES

1. Army Facilities Energy Plan, 9 December 1984.

2. Engineer Technical Letters (ETL's):

   a. 1110-3-254 Use of Electric Power for Comfort Space Heating
   b. 1110-3-282 Energy Conservation
   c. 1110-3-294 Interior Design Temperatures
   d. 1110-3-332 Economic Studies

3. Architectural and Engineering Instructions, Design Criteria dated 13 March 1987

4. Technical Manuals:

   a. TM 5-785 Engineering Weather Data
   b. TM 5-800-2 General Criteria Preparation of Cost Estimates
   c. TM 5-800-3 Project Development Brochure

5. Army Regulations:

   a. AR 415-15 Military Construction Army (MCA) Program Development
   b. AR 415-17 Cost Estimating for Military Programming
   c. AR 415-20 Project Development and Design Approval
   d. AR 415-28 Department of the Army Facility Classes and Construction Categories
   e. AR 415-35 Minor Construction, Emergency Construction, and Replacement of Facilities Damaged or Destroyed
   f. AR 420-10 General Provisions, Organization Function, and Personnel
   g. AR 5-4 Change 1 Department of the Army Productivity Improvement Program

6. CEHSC-FU (420.10a), Energy Conservation Investment Program (ECIP) Guidance, dated 25 April 1988.

LIST OF ABBREVIATIONS

A/C	Air Conditioning
ASHRAE	American Society of Heating Refrigeration and Air Conditioning
CE	Corps of Engineers
DHW	Domestic Hot Water
DOD	Department of Defense
ECIP	Energy Conservation Investment Program
ECO	Energy Conservation Opportunity
EEAP	Energy Engineering Analysis Program
ESOS	Energy Savings Opportunity Survey
EWH	Electric Water Heater
FY	Fiscal Year, October 1 Thru September 30
HVAC	Heating, Ventilating and Air Conditioning
KW	Kilowatt
KWH	Kilowatt-Hour
LCCA	Life Cycle Cost Analysis
MBTU	Million British Thermal Unit
OH&P	Overhead and Profit
POD	Pacific Ocean Division
SIR	Savings to Investment Ratio
SNG	Synthetic Natural Gas
SOW	Scope of Work
SPB	Simple Payback Period
TM	Technical Manual
UPW	Uniform Present Worth
USASCH	U.S. Army Support Command, Hawaii

CHAPTER 1
GENERAL DISCUSSION

1.1 INTRODUCTION

This Energy Savings Opportunity Survey (ESOS) is to identify Energy Conservation Opportunities (ECO's) which are practical and economical for the reduction of energy consumption in accordance with the Army Facilities Energy Plan.

1.2 GENERAL SCOPE OF WORK

The work to be performed under this project includes the following tasks:

A. Coordinate with the on-going and proposed related projects.

B. Conduct a limited site survey required to identify applicable ECO's and obtain necessary data to evaluate the ECO's.

C. Evaluate applicable ECO's to determine their feasibility in accordance with current criteria.

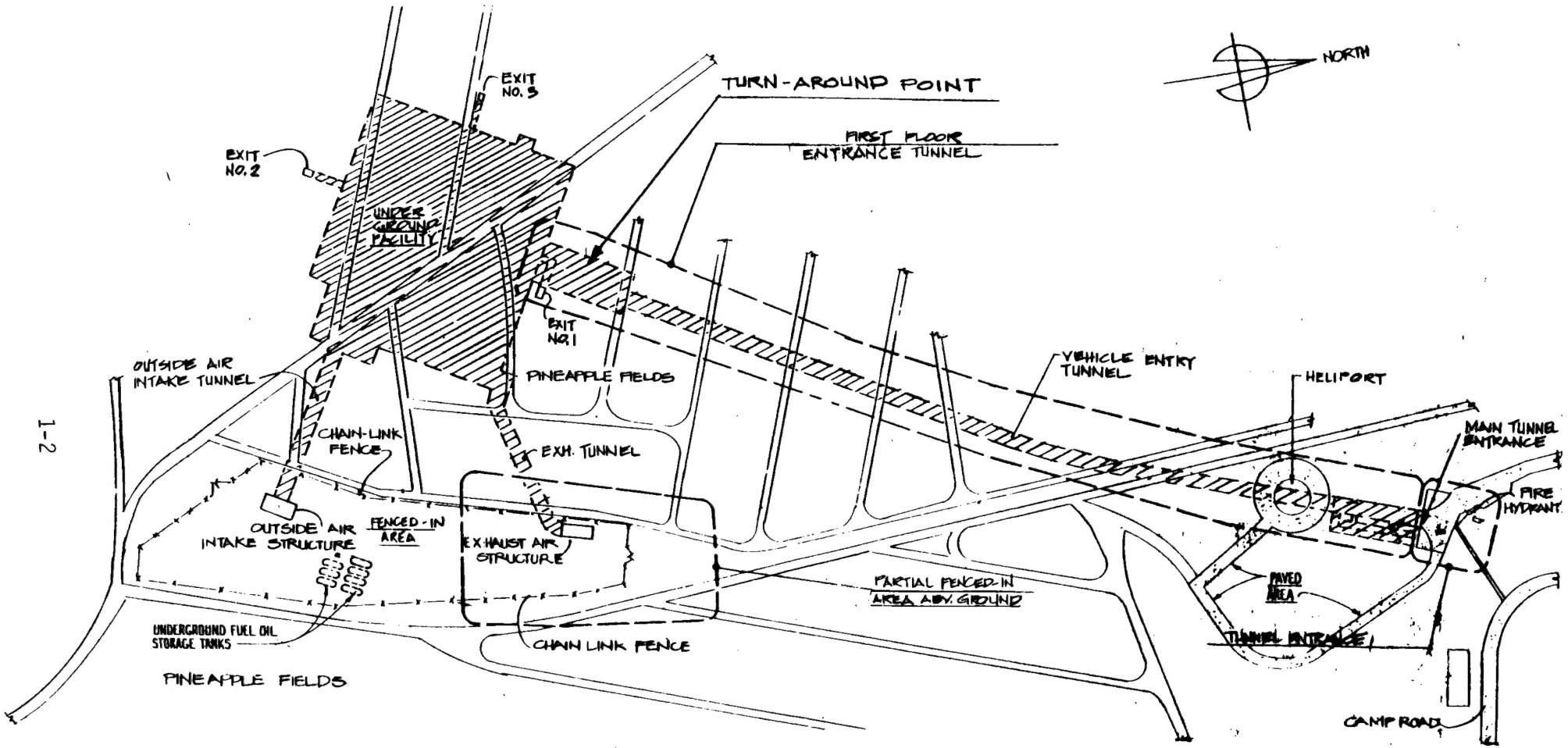
D. Prepare programming and implementation documents for the recommended ECO's.

E. Prepare a comprehensive report to present the work performed including energy analysis, the results and recommendations.

The facility covered under this project is the U.S. Army Field Station Kunia, located at Kunia in Oahu, Hawaii, (See attached Figures 1-1, 1-2, 1-3 and 1-4).

1.3 SPECIFIC SCOPE OF WORK

The following are the specific items defined in ANNEX B of the project scope of work dated May 26, 1987 and as amended during the preproposal meeting (see memorandum dated June 5, 1987, enclosed in Appendix A).



SITE PLAN
1" = 200'

FIGURE 1-1
SITE PLAN

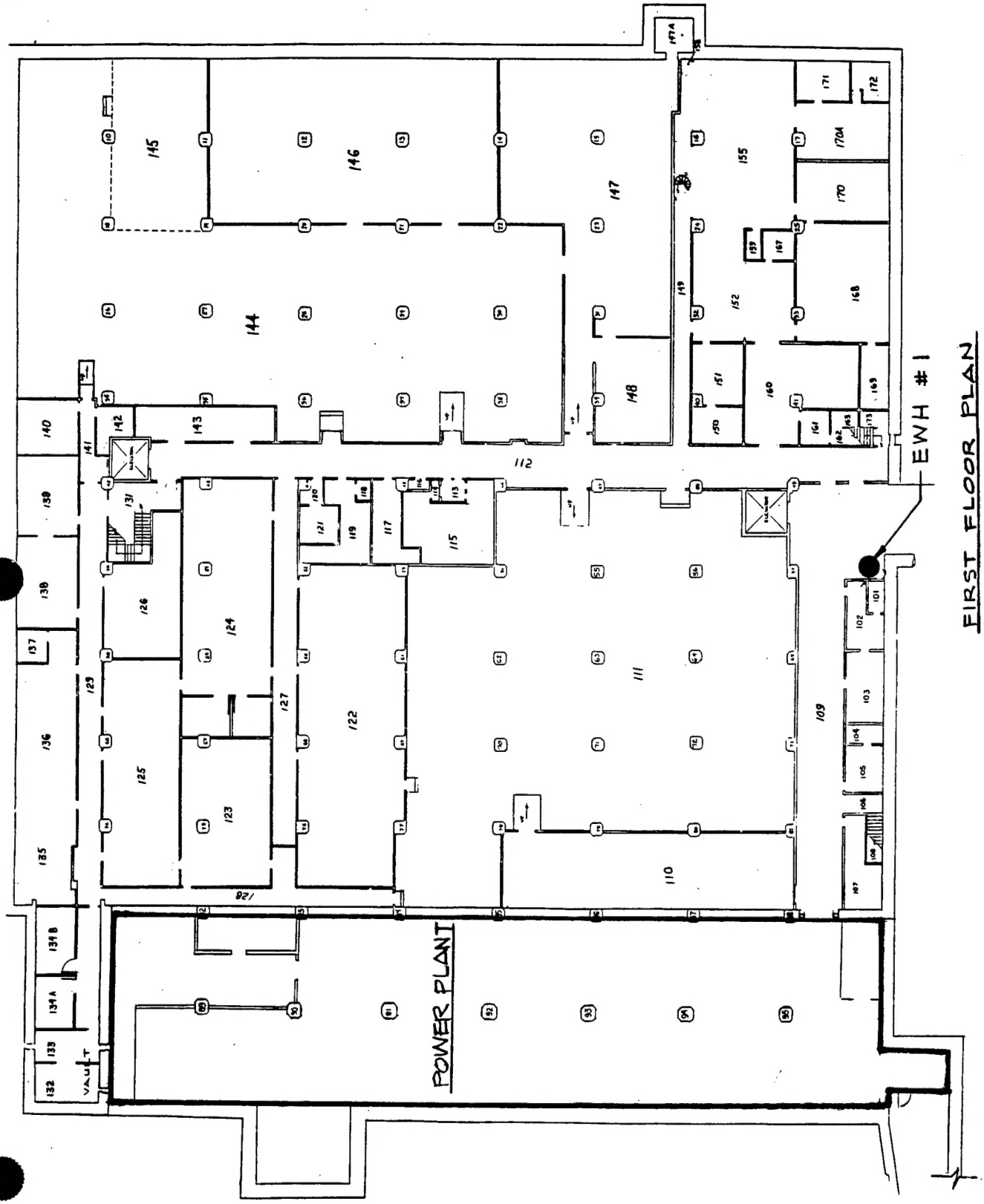
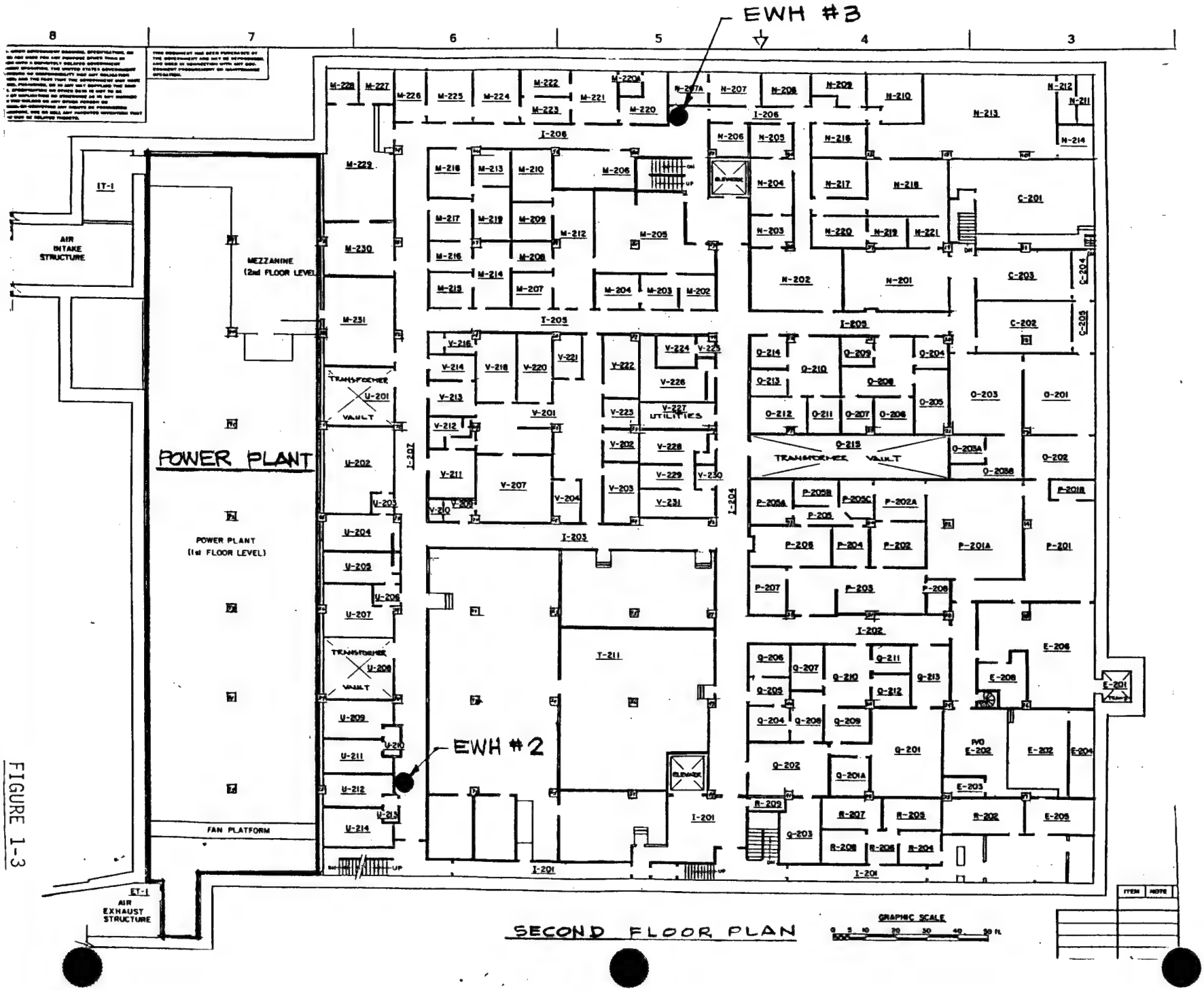


FIGURE 1-2

FIRST FLOOR PLAN



SECOND FLOOR PLAN

FIGURE 1-3
SECOND FLOOR PLAN

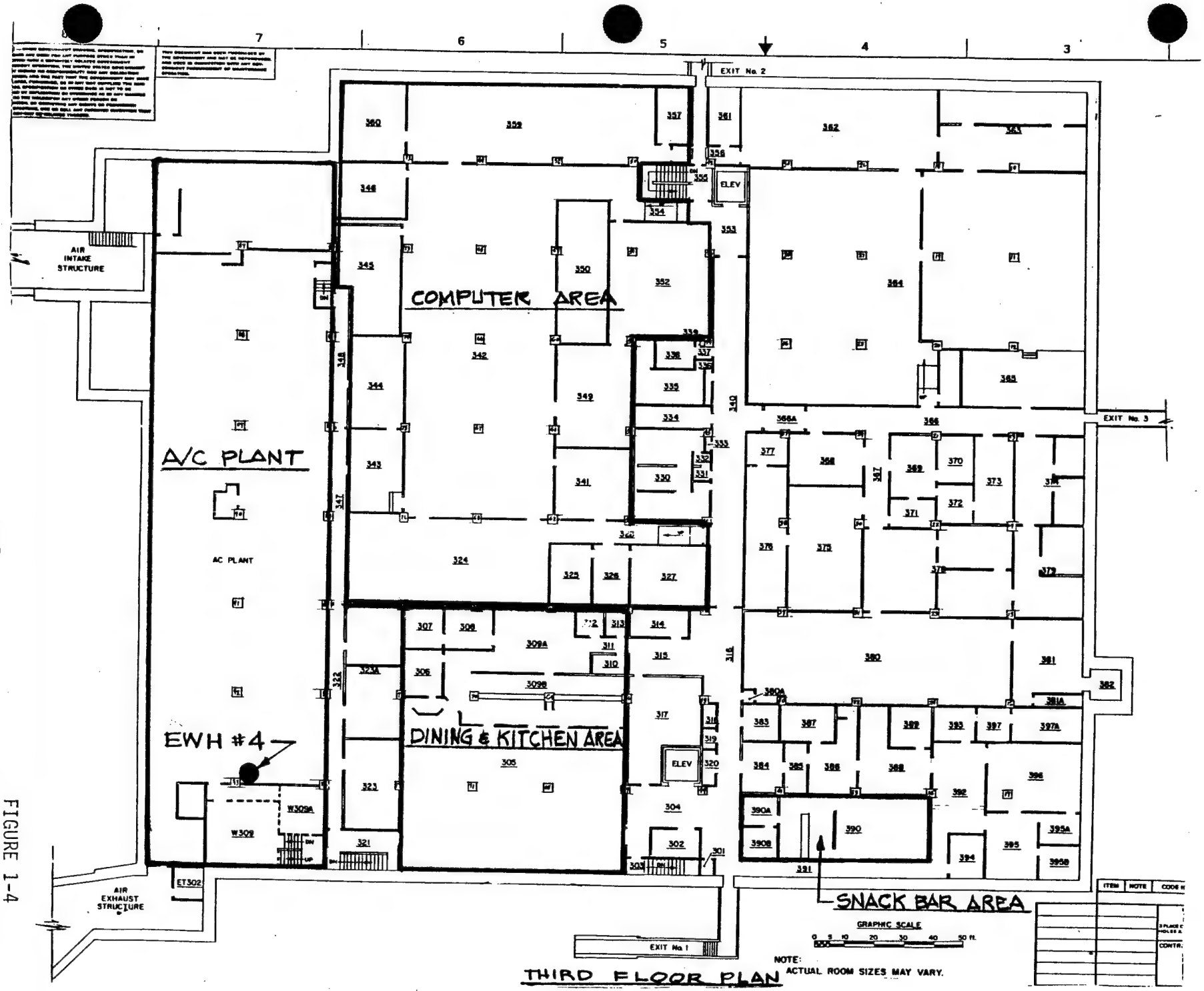


FIGURE 1-4
THIRD FLOOR PLAN

A. Survey of energy savings opportunities in the dining hall and snack bar areas.

B. Consolidation of the individualized water heaters to the central domestic hot water system.

C. Analysis of the possibility to use more efficient entrance tunnel exhaust and lighting system.

D. Evaluation of the possibility to install a dimmer or alternate switching for fluorescent lighting in the computer area (third floor).

E. Analysis of the possibility to use more efficient lighting for the parking area, upper fenced area and power plant.

F. Survey of cooling requirements and operations for the microwave facility in the upper exhaust tunnel to tie with the central chilled water system.

G. Evaluation of the underground ventilation system to ensure the most efficient outside air system which would maintain a positive pressure in the entire facility.

Although the original scope of work included a survey of the chilled water system, it was deleted from the scope of this study because of another ongoing project that already encompasses the entire chilled water system. The other projects are under design by other A/E's as described in the next paragraph.

1.4 RELATED PROJECTS

The Government informed this A/E that the following MCA projects are currently under design and may affect this study:

A. FY86 MCA PN173, A/C Upgrade

A project to upgrade the existing A/C system including the replacement of chilled water lines, air handling units, and improvements to the ventilation system.

B. FY88 MCA PN12, Power Upgrade

A project to convert 2.4 KV electrical system to 4.16 KV system. The work includes replacing transformers, installing bus ducts, and constructing a primary substation.

C. FY88 MCA PN 13, Life/Safety Upgrade

A project to construct additional corridors, stairways, exterior exits, sprinkler system, enclosure of stairways, and upgrading the alarm system.

D. FY88 MCA PN 9215460, Operations General Purpose

A project to renovate the facility by adding raised floors and drop ceilings on the second and third floors, renovating office spaces on the first and second floors, and renovating A/C systems in these impacted areas.

Reviewing the scope of the above projects, it was found that the first project, FY86 MCA PN 173, A/C Upgrade has a potential impact on this project. After the field investigation, a close coordination with Mechanical Engineers of Hawaii Corporation, the firm undertaking the project design, was made in order to incorporate their design approaches in this study.

1.5 ENERGY CONSERVATION OPPORTUNITIES

1.5.1 Applicable Energy Conservation Opportunities

During the field investigation, the suggested ECO's as listed in Annex A of the contract scope were carefully evaluated to select potential ECO's under this study. The following are the potential ECO's that were analyzed for their feasibility:

A. Architectural ECO's

Since the facility is an underground structure, no architectural ECO is applicable.

B. Mechanical ECO's

M-1 Timeclock control of A/C system in dining area.

M-2 Convert A/C system to chilled water system for microwave facility.

M-3 Consolidate individual electric water heaters to central system.

M-4 Timeclock control of kitchen exhaust system.

M-5 Improve entrance tunnel ventilation.

C. Electrical ECO's

E-1 Install dimmers for computer area lighting.

E-2 Replace incandescent fixtures with fluorescent in power plant.

E-3 Replace incandescent reflector type fixtures with fluorescent in A/C plant.

E-4 Replace incandescent fixtures with fluorescent for A/C plant's motor control center.

E-5 Replace incandescent fixtures with HPS fixtures along perimeter fence.

1.5.2 Inapplicable Energy Conservation Opportunities

The other suggested ECO's in Annex A of the contract scope are inapplicable. The list of inapplicable ECO's and the basis for their deletion are described in CHAPTER 4.

1.5.3 Maintenance Items

Some applicable ECO's which are labor intensive and can be implemented by installation maintenance personnel using regular maintenance and repair funds are classified as Maintenance Items. The following are the list of recommended Maintenance Items.

A. Reset the thermostat to 78°F in the dining area.

B. Replace all burnt out fluorescent lamps and ballasts with energy saving type (applicable to all areas not marginally illuminated). Clean diffusers prior to relamping.

C. Reset the thermostat to 78°F in the snack bar.

D. Reset electric water heaters to 120°F.

E. Replace damaged diffusers for snack bar light fixtures.

F. Disconnect ballasts for light fixtures with two of four lamps removed in the computer area, 3rd floor.

G. Block-off forty (40) exhaust outlets in the entrance tunnel.

1.6 ENERGY AND LIFE CYCLE ANALYSIS

All applicable ECO's were analyzed and evaluated for their economic feasibility of implementation in accordance with the latest criteria. The evaluation process includes energy and other savings analysis, project cost estimate, and life cycle cost (LCC) analysis to determine the cost effectiveness. Cost effective projects are defined as those for which the Savings to Investment Ratio (SIR) is 1.0 or greater.

Analysis of all applicable ECO's and their backup data are included in Appendix B. The results of LCC analysis and the recommendations are summarized in CHAPTER 6.

1.7 ENERGY END-USE ANALYSIS

The energy end-use analysis was prepared in order to estimate the existing building energy consumption as a baseline for the assessment of energy savings resulted from the recommended ECO's. For the analysis, the building energy consumption was broken down into four (4) categories; air conditioning, lighting, domestic hot water and other equipment.

The results of building energy end-use analysis and the assessment of recommended ECO's energy savings are included in CHAPTER 5.

CHAPTER 2
METHODOLOGY

2.1 GENERAL APPROACH

The major elements of this study are:

* A limited field survey of designated areas in the facility.
* Identification of applicable ECO's and Maintenance Items.
* An energy savings analysis of applicable ECO's for designated areas.
* A cost estimate of initial investment and other costs.
* A life cycle cost analysis to determine project economic feasibility.
* Ranking of ECO's from highest to lowest SIR.
* Preparation of programming and implementation documentation for project funding and implementation of recommended ECO's.
* A report summarizing the results of surveys and analyses, and recommendations for implementing energy conservation opportunities in the designated areas.

2.2 FIELD INVESTIGATIONS

The field investigation included the tasks of: (1) Preparation of survey forms and procedures; (2) obtaining as-built drawings of designated areas; (3) performing on-site inspection of the areas and their energy systems.

Survey forms were prepared to establish a format for the recording of data. The information, especially the updating of as-built conditions, was notated directly on the drawings and in notebooks. The results of field investigations are consolidated in CHAPTER 3.

The plan files at the installation were searched during January 1988 to find and obtain relevant design drawings and as-built drawings for the areas to be surveyed.

A field survey team consisting of specialists was dispatched for the field investigation. The team was equipped itself with tools and measuring instruments, which included:

* Sling psychrometer to check the ambient dry bulb and wet bulb temperatures.

* Thermometer for measurement of Domestic Hot Water (DHW) temperatures.

* Anemometer for measurement of air velocities.

* Flashlights to peer into unlit spaces (attics, closets, behind equipment etc.).

* Penknife and brush to clean off equipment nameplates.

* Light intensity meter.

* Tape measure.

* Notebooks, and survey forms.

Prior to starting the field survey, a project meeting was held on January 11, 1988 to brief Army staff members on details and intended procedures for the field survey. The field survey was conducted three times: on January 14, 1988 for the preliminary investigation; on February 19, 1988 for the final investigation; and on April 28, 1988 for the supplemental investigation.

The survey team inspected the lighting, ventilation, air conditioning, and domestic hot water system of designated areas in the facility. The procedure of the survey at each area was:

* Verify as-built drawings and equipment schedules.

* Interview the building manager or custodian to obtain occupancy information, operating schedules, maintenance procedures and problems, and relevant future construction plans.

* Observe and note conditions of the energy system equipment, thermostat setpoints, time clock settings, etc.

* Identify areas and items of energy waste for development of potential ECO's.

* Make spot checks of space temperatures, domestic hot water temperatures, and room lighting levels.

Supplemental data, as required, was obtained from Engineering Office of the facility and the Director of Facilities Engineering person-of-contact.

2.3 IDENTIFYING ENERGY CONSERVATION OPPORTUNITIES

The procedure for identification of potential ECO's was for the field survey team members to use their experience and training to observe and note instances of energy waste. It started with the specific ECO's suggested in the scope of work, then extended to the general ECO's. Energy waste areas for which solutions were not quickly apparent were noted for post-survey analysis by the engineers.

Some of the ECO's from the general list were inapplicable to this installation and the various reasons include:

* Heating systems are not required for the facility.

* No ECO's related with the building envelope are applicable as the facility is an underground structure.

* Weatherization items are not required for Hawaii's mild climate.

* Incompatibilities with existing equipment or operations.

Potential ECO's were analyzed at various levels of detail, depending primarily on its practicality. Some were rejected based on both prior experience and results of previous studies. Promising ECO's were designated as "applicable ECO's" and were subjected to more detailed analysis including calculation of energy savings and life cycle cost analysis. Specific applicable and inapplicable ECO's are described in CHAPTER 4.

2.4 ENERGY SAVINGS ANALYSIS

Energy conservation opportunities which were identified are of the following basic types.

* Reduction of lighting energy by refixturing with high efficiency fixtures.

* Utilizing an alternate energy source to heat domestic hot water: Heat pump system.

* Reducing the volume of outside air.

* Modifications to controls: time clock controls for A/C and ventilation systems.

* Replacing exhaust fans with more efficient fans.

Spot measurements of the lighting levels revealed areas where excessive lighting could be reduced. Appropriate Army regulations were used as guidelines to the proper lighting levels. Areas illuminated by incandescent lamps were considered for replacement with high efficiency light sources. The potential savings in electric power were multiplied by the estimated annual equivalent full load hours of the facility lighting system to obtain estimated annual energy savings.

In estimating the potential energy savings due to improved control of the ventilation and air conditioning equipment and the reduction of heat gain to conditioned spaces, it is required to know the climatic conditions at the installation, the equivalent full load hours of the air conditioning equipment, and the total amount of cooling load reduction. Weather data for the installation was obtained from TM 5-785, Engineering Weather Data. The equivalent full load hours and annual energy requirements of the air conditioning equipment were calculated using an in-house computer program based on the Modified Bin Method per ASHRAE. The in-house computer program is described in CHAPTER 5.

For equipment related ECO's, energy efficiencies were estimated from typical manufacturers' data. Where available, this data was specific to the installed equipment, otherwise it was generic data.

The foregoing description is brief and general, intended to illustrate the methodologies which were followed. Details of data sources, assumptions, references, and calculations are given for each applicable ECO, in Appendix B.

Energy savings from applicable ECO's resulted in a reduction of electricity consumption, which is in terms of KWH. The KWH figure was converted to a BTU basis using the conversion factor as specified in the latest ECIP guideline:

Electric Power: 3,413 BTU/KWH

2.5 PROJECT COSTS

The initial costs of ECO's are the non-recurring initial capital costs of the applicable ECO's, which include construction, design, supervision, inspection, and overhead. Direct costs were determined for each ECO in current (April 1988) dollars using a variety of sources, as appropriate:

* Means Cost Estimating Manuals, latest edition: "Building Construction Cost Data," "Mechanical Cost Data," "Electrical Cost Data," "Repair and Remodeling Cost Data," etc.

* Engineer's estimate.

* Vendor's budget quotes.

To the direct costs were added the following adjustments:

* Contractor's Overhead and Profit (25 percent).

* Supervision, Inspection and Overhead (7.5 percent).

* Engineering and Design Fees (6 percent).

"Direct Cost" plus "Contractor's Overhead and Profit" equals "Construction Cost." "Construction Cost" is the input to Line 1A of the ECIP analysis (see Sample Form in Paragraph 2.6).

2.6 LIFE CYCLE COST ANALYSIS

A life cycle cost (LCC) analysis was performed for each applicable ECO. Using the format outlined in the ECIP Guidance (see Figure 2-1, page 2-9 for sample LCC Analysis). The Contract SOW specifies that LCC analyses be performed according to the procedure outlined in a letter from DAEN-ZCF-U, "Energy Conservation Investment Program (ECIP) Guidance." The ECIP is a Military Construction (MCA) funded program for retrofitting Department of Defense energy systems and buildings to make them more energy efficient and provide substantial savings in operating costs. Since the total amount of recommended projects is less than $200,000 which is the minimum requirement of ECIP Fund, non-ECIP Fund such as FY89 OMA Fund will be applied for the implementation of the recommended projects.

Cost effective projects are those for which the Savings to Investment Ratio (SIR) is 1.0 or greater. The SIR is the sum of discounted annual net cost savings for the economic life of the system divided by the initial capital cost of the project. ECIP allows project savings to include up to 25 percent non-energy savings, such as reductions in maintenance costs.

In summary, the ECIP analysis includes the following features:

* Present worth value is calculated using a seven (7) percent discount factor.

* Uniform Present Worth (UPW) factors for annual energy cost/savings for Hawaii installations are the Region 9 factors of ECIP Guidance dated 25 April 1988.

* The estimated construction cost, the unit costs of energy and labor/material costs at the installation on the date of the analysis are used as the basis for life cycle cost calculations.

* The economic life for all analyses is based on the expected useful life of the retrofit action, or the remaining useful life of the facility or system being retrofitted, whichever is least. The maximum allowable economic life for various types of projects are given in the ECIP Guidance. Those which are applicable to ECO's at the installation are:

HVAC Systems	15 years
Lighting Systems	25 years
Energy Recovery Systems	25 years

Additional specific information on the methodology of the ECIP analysis, energy unit costs, UPW factors for energy price escalation, and a sample calculation sheet are as follows:

Energy Costs

Average Cost of Purchased Electricity = $0.063/KWH

$$\frac{\$0.063/KWH}{0.003413\ MBTU/KWH} = \$18.46/MBTU$$

(Average cost of FY88 5 months, Oct. 87 through Feb. 88, see Table 3-1, Page 3-24).

The facility utilizes electricity as a single source of energy for its normal operation. The Government directed the A/E to use the actual local energy cost for this study in lieu of the regional average energy cost because the local cost is lower than the regional average cost.

UPW Discount Factors

	Economic Life	
	15 years	25 years
Electricity	8.04	10.42
Non-Energy Items	9.11	11.65

FIGURE 2-1

SAMPLE LCC ANALYSIS

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	KUNIA, HAWAII	REGION NO.:	9
PROJECT TITLE:	EEAP/KUNIA	PROJECT NO.:	
DISCRETE PORTION NAME:	TIME CLOCK CONTROL DINING AREA, 3RD FL	FISCAL YEAR:	1988
		ANALYSIS DATE:	AUG 1988
PREPARED BY: R.M. TOWILL	CORPORATION	ECONOMIC LIFE IN YRS:	15

1. INVESTMENT

A. CONSTRUCTION COST		1882.00	
B. SIOH	7.5% OF 1A	141.15	
C. DESIGN COST	6.0% OF 1A	112.92	
D. ENERGY CREDIT CALC	((1A+1B+1C) X 0.9)	1922.46	
E. SALVAGE VALUE		0.00	
F. TOTAL INVESTMENT	(1D - 1E)		1922.46

2. ENERGY SAVINGS (+) / COSTS (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST, AND DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	18.46	90.82	1676.54	8.04	13479.36	
B.						
C.						
D. TOTAL		90.82	1676.54			13479.36

3. NON ENERGY SAVINGS (+) / COSTS (-)

A. ANNUAL RECURRING (+/-)			0.00
(1) DISCOUNT FACTOR		9.11	
(2) DISCOUNTED SAVINGS(+)/COST(-)	(3A X 3A1)		0.00

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS(+) COSTS(-) (1)	YEAR OF OCCURENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS(+)/COSTS(-) (4)
a.	0	0	0	0
b.	0			0
c.	0			0
d. TOTAL	0			0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS(+)/COSTS(-) (3A2+3Bd4) $ 0.00

D. PROJECT NON-ENERGY QUALIFICATION TEST

(1) 25% MAX NON-ENERGY CALC (2D5 X .33)	4448.19

(a) IF 3D1 IS = OR > 3C GO TO ITEM 4
(b) IF 3D1 IS < 3C CALC SIR=(2D5+3D1)/1F
(c) IF 3D1b IS = OR > 1.0 GO TO ITEM 4
(d) IF 3D1b IS < 1.0 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS (2D3+3A+(3B1d/ECONOMIC LIFE))	1676.54
5. TOTAL NET DISCOUNTED SAVINGS/COST (2D5+3C)	13479.36
6. DISCOUNTED SAVINGS RATIO (SIR)=((5.)/1F)=	7.01

CHAPTER 3
FINDINGS OF FIELD INVESTIGATION

3.1 GENERAL

This chapter is to present the findings of field surveys conducted on designated areas under the scope of work in order to identify potential Energy Conservation Opportunities (ECO's). The findings include the following items for each area:

A. Area function and operating hours.

B. Brief description of energy systems which are existing or to be modified by the renovation projects on-going or programmed.

* Air Conditioning and Ventilating System
* Domestic Hot Water System
* Lighting System

C. Recommended ECO's for ECIP life cycle cost analysis and related observations.

D. Recommended ECO's for Maintenance Items.

3.2 DINING HALL AND KITCHEN AREA (3RD FLOOR)

The area includes approximately 4,500 S.F. of dining facility and 2,500 S.F. of kitchen facility.

Operating Schedule:

Dining Hall: 24 hours/day, 7 days/week, 4 meals/day

Breakfast	6:00 a.m. - 7:30 a.m.
Lunch	11:00 a.m. - 12:45 p.m.
Dinner	5:45 p.m. - 7:30 p.m.
Midnight	1:00 a.m. - 2:45 a.m.

Kitchen: 24 hours/day, 7 days/week

Number of People Served:

	Weekdays	Weekends
Breakfast	100	100
Lunch	300	100
Dinner	100	100
Midnight	100	100

3.2.1 Air Conditioning and Ventilating System

Air conditioning is provided by a central chilled water air handling unit (AHU W-1, located in Room 317). The unit also serves adjacent Rooms 314 and 317 and Hallways 304, 315 and 316. This unit will be replaced with a new unit under A/C Upgrade Project (PN173) and existing air distribution duct work will be reused as it is properly insulated and in good condition.

A separate exhaust system from the building ventilating system is provided for the exhaust of kitchen and dishwashing areas (13,400 CFM). The building air system supplies 11,740 CFM of outside air directly to the kitchen and 2,470 CFM of outside air through AHU W-1. The 660 CFM of exhaust air from the toilets and can-washroom is exhausted through the building exhaust air system.

Observed Room Conditions

Dining Area:	73°F DB	64.5°F WB	64% RH
Serving Area:	78°F DB	67°F WB	57% RH
Kitchen Area:	76°F DB	66.5°F WB	61% RH

3.2.2 Domestic Hot Water System

All required domestic hot water is supplied from the central domestic hot water system located in the A/C Plant. The domestic hot water system is covered under a separate "area" (see paragraph 3.7, page 3-12).

3.2.3 Lighting System

Existing lighting is fluorescent for dining (luminous ceiling), kitchen, and preparation areas. The lighting for the dining circulation and patron serving areas is mercury vapor.

Kitchen personnel are on duty 24 hours per day and therefore lighting fixtures in food preparation areas operate continuously.

Lighting in dining and patron serving areas is turned off for brief periods between serving hours, after lunch 3:00 to 5:00 p.m. and after dinner 9:30 to 12:00 p.m.

Total connected lighting load is approximately 11.6 KW. Existing lighting levels measured did not exceed DOD criteria. Measured and required lighting levels by general areas are as follows:

Area	Required FC	Actual FC	Fixture Type	Qty	Mounting Height
Dining	25	20 - 30	Fluor-Raceway &	142	10'- 0"
			Mercury-Downlight	30	10'- 0"
Self-Service	30	25 - 30	Mercury-Downlight	14	8'- 0"
Serving Line	30	20 - 30	Fluor-Pendant, 4'L	16	7'- 0"
Kitchen	70	40 - 50	Fluor-Surface, 2'x 4'	13	8'- 0"
Office	50	40 - 45	Fluor-Surface, 2' x 4'	11	8'- 0"

3.2.4 Recommended ECO's for Analysis

A. Timeclock control for the A/C system (ECO M-1). The air handling unit (AHU W-1) can be deenergized between the serving hours.

3.2.5 Recommended ECO's for Maintenance Items

A. Reset the thermostat to maintain the room temperature in the Dining Hall at 78°F.

B. Replace all burnt out fluorescent lamps and ballasts with an energy saving type in areas not marginally illuminated. Clean diffusers prior to relamping.

C. Turn off light fixtures in dining and patron serving areas after breakfast and midnight snack when the areas are not occupied.

3.3 SNACK BAR AREA (3RD FLOOR)

The area includes approximately 1,350 S.F. of snack, kitchen and office room.

Operating Schedules:
24 hours/day, 7 days/week

Number of People Served:
30 to 35 people during peak period

3.3.1 Air Conditioning and Ventilating System

Air conditioning is provided by a central chilled water air handling unit (AHU AF-6). The unit also serves adjacent areas including Rooms 383, 384, 386, 387, 388 and 389. The unit will be replaced with a new unit under A/C Upgrade Project (PN 173) and existing air distribution duct work, which is properly insulated, will be reused. The 645 CFM of outside air is supplied through the air handling unit and exhausted through the building exhaust air system.

Observed Room Conditions

Dining Area:	74.5°F DB	63°F WB	49% RH
Serving Area:	77°F DB	64°F WB	49% RH
Kitchen Area	79°F DB	66°F WB	51% RH

3.3.2 Domestic Hot Water System

All required domestic hot water is supplied from the central domestic hot water system located in the A/C plant. The domestic hot water system is covered under a separate "area" (see paragraph 3.7, page 3-12).

3.3.3 Lighting System

Existing lighting is fluorescent for serving/kitchen and office areas and incandescent for the dining area. Incandescent lighting in the dining area is provided by stem mounted decorative two lamp fixtures. An integral 3-way switch (off, 1 lamp and 2 lamps) provides individual control of each light fixture and maximum flexibility in energy conservation. Observation of patrons during the field investigation revealed consistent turn-off of light fixtures upon their exit. Therefore, only fixtures in use remained in operation. Wall switches provide the circuit control. The stem mounted fixtures appeared in good condition except for one fixture with a damaged diffuser.

In spite of the inefficiency of these incandescent fixtures, we do not recommend the replacement due to aesthetic considerations and flexibility of the present switching scheme. Fluorescent lighting in the serving/kitchen area operates continuously since the Snack Bar provides 24-hour service. Fluorescent fixtures in the office are locally switched off during management non-working hours. Total connected lighting load is approximately 3.6 KW. Existing lighting levels measured did not exceed DOD criteria. Measured and required lighting levels by general areas are as follows:

Area	Required FC	Actual FC	Fixture Type	Qty	Mounting Height
Dining	25	8 - 14	Incand-Pendant	15	6'- 0"
Serving/Kitchen	30/70	40 - 55	Fluor-Recess, 2' x 4'	4	9'- 0"
Office	50	30 - 60	Fluor-Recess, 8'L	4	9'- 0"

3.3.4 Recommended ECO's for Analysis

No recommended ECO's.

3.3.5 Recommended ECO's for Maintenance Items

A. Reset the thermostat to maintain the room temperature in the dining area at 78°F.

B. Replace damaged diffuser for the dining area luminance.

C. Replace all burnt out fluorescent lamps and ballasts with an energy saving type in areas not marginally illuminated. Clean diffusers prior to relamping.

3.4 COMPUTER AREA (3RD FLOOR)

The area includes approximately 15,000 S.F. of computer area.

Operation Schedule

24 hours/day, 7 days/week

3.4.1 Air Conditioning and Ventilating System

The air conditioning and ventilating system is not included in the scope of work.

3.4.2 Domestic Hot Water System

Not applicable. There is no domestic hot water in the computer area.

3.4.3 Lighting System

Existing lighting is fluorescent for all computer areas. Parabolic louvered fixtures are used throughout except for the library and adjacent rooms of office type operation where prismatic diffuser fixtures are provided. Lighting control is via local wall switches, however, luminaries are never switched off since the computer area is manned 24 hours per day. Exceptions are the library and office type room where fixtures are turned off manually during non-working hours (8 hours/day operation).

Several light fixtures had one or two lamps disconnected (in-house energy conservation measure in isolated areas not requiring adequate lighting). The range of lighting levels measured were wide due to parabolic louvers which cut off between fixtures.

Computer area personnel had no complaints regarding glare on screens, fatigue or discomfort due to excessive or inadequate lighting.

Total connected lighting load is approximately 22.6 KW.

Existing lighting levels measured did not exceed DOD criteria. Measured and required lighting levels by general areas are as follows:

Area	Required FC	Actual FC	Fixture Type	Qty	Mtg Height
Computer Room #1 (3,850 SF)	50	20 - 56	Fluor-Recess, 2'x 4' w/Parabolic Louver	39	9'- 0"
Computer Room #2 (850 SF)	50	25 - 60	Fluor-Recess, 2'x 4' w/Parabolic Louver	10	9'- 0"
Computer Room #3 (850 SF)	50	43 - 60	Fluor-Recess, 2'x 4' w/Parabolic Louver	10	9'- 0"
Computer Room #4 (250 SF)	50	27 - 52	Fluor-Recess, 2'x 4' w/Parabolic Louver	2	9'- 0"
Computer Room #5 (1,850 SF)	50	32 - 45	Fluor-Recess, 2'x 4' w/Parabolic Louver	19	9'- 0"
Computer Room #6 (1,650 SF)	50	37 - 48	Fluor-Recess, 2'x 4' w/Parabolic Louver	17	9'- 0"
Computer Room #7 (2,450 SF)	50	35 - 60	Fluor-Recess, 2'x 4' w/Parabolic Louver	24	9'- 0"
Office (850 SF)	50	25 - 43	Fluor-Recess, 2'x 4' w/Prismatic Diffuser	8	9'- 0"
Library (700 SF)	50	25 - 55	Fluor-Recess, 2'x 4' w/Prismatic Diffuser	8	9'- 0"

3.4.4 Recommended ECO's for Analysis

A. Install dimmers to control computer area lighting (ECO E-1).

B. Application of occupancy sensors to control computer area lighting is not warranted since the staff is on duty 24 hours per day. For smaller rooms (office type operation and library), manual switching efficiency limits occupancy sensor feasibility.

C. Reflectors are not applicable to the existing parabolic louver type fixtures.

3.4.5 Recommended ECO's for Maintenance Items

A. Replace all burnt out fluorescent lamps and ballasts with an energy saving type in areas not marginally illuminated. Clean diffusers prior to relamping.

B. Disconnect ballasts for light fixtures with two of four lamps removed.

3.5 POWER AND A/C PLANT

The area includes approximately 30,000 S.F. of power generation, air conditioning and ventilating equipment space on two floor levels.

3.5.1 Air Conditioning and Ventilating System

The air conditioning and ventilating system was excluded from the scope of work as modifications are currently under design by Mechanical Engineers of Hawaii Corp. Only the overall ventilating system of the facility is covered under this report (see Paragraph 3.8).

3.5.2 Domestic Hot Water System

The domestic hot water system is covered under the separate paragraph (see Paragraph 3.7, page 3-12).

3.5.3 Lighting System

3.5.3.1 Power Plant (Lower Level)

Existing lighting is incandescent and mercury vapor for general illumination and supplemented by fluorescent lighting over selected task areas.

Stem-mounted mercury vapor industrial type fixtures are used for high bay lighting throughout with incandescent fixtures provided over each generator, critical equipment, and panels.

Fluorescent strip and louvered channels illuminate switchboard and control rooms at mezzanine level, offices, areas below A/C ducts, electrical starter/control equipment and work tables.

Mercury vapor fixtures are in good condition. The remaining fixtures are generally dirty with partial diffuser discoloration and surface corrosion is evident on certain units. High bay and critical equipment lighting is on continuously. Fluorescent lighting below A/C ducts and non-critical areas is provided with local switches.

Total connected lighting load is approximately 24.8 KW. Existing lighting levels measured did not exceed DOD criteria except Task Areas. Measured and required lighting levels by general areas are as follows:

Area	Required FC	Actual FC	Fixture Type	Qty	Mounting Height
General Illumination	15	10 - 15	Mercury-High Bay Indus	37	22'- 0"
Task Areas*	50	70 - 90	Fluor-Channel	62	8'- 0"

*Measured task area FC levels represent highest reading on selected areas of work plane.

3.5.3.2 A/C Plant (Upper Level)

Existing lighting is incandescent and mercury vapor for general illumination and supplemented by fluorescent lighting over selected task areas.

Stem-mounted incandescent reflector type, and mercury vapor industrial type fixtures are provided in approximately equal proportions. Mercury vapor fixtures are recently installed as part of an upgrade of existing incandescent fixtures. However, the replacement was limited to non-critical areas, since instantaneous start-up type fixtures (i.e., incandescent), are superior over equipment requiring manual starting during power failures.

Fluorescent strips and louvered channels located at selected task areas are generally dirty with spotted surface corrosion.

All fixtures burn continuously except for task lighting which is locally switched off in areas of low use by maintenance personnel.

Total connected lighting load is approximately 28.7 KW. Existing lighting levels measured did not exceed DOD criteria. Measured and required lighting levels by general areas are as follows:

Area	Required FC	Actual FC	Fixture Type	Qty	Mounting Height
General	15	6 - 15	Mercury-High Bay Indus	14	16'- 0"
Illumination			and Incand-Reflector	11	16'- 0"
Task Areas	50	30	Fluor-Channel	49	8'- 0"

3.5.4 Recommended ECO's for Analysis

A. Replace incandescent fixtures (over generators and critical equipment) with fluorescent fixtures in the Power Plant (ECO E-2).

B. Replace incandescent reflector type fixtures with fluorescent fixtures in the A/C Plant (ECO E-3).

C. Replace incandescent fixtures (near motor control centers, along south-east wall) with fluorescent fixtures in the A/C Plant (ECO E-4).

3.5.5 Recommended ECO's for Maintenance Items

A. Replace all burnt out fluorescent lamps and ballasts with an energy saving type in areas not marginally illuminated. Clean diffusers prior to relamping.

3.6 MICROWAVE FACILITY (UPPER EXHAUST TUNNEL)

The facility includes approximately 600 S.F. of microwave equipment space constructed of prefabricated building panels. The facility is wholly situated within the Upper Exhaust Tunnel.

Operating Schedule

24 hours/day, 7 days/week

3.6.1 Air Conditioning System

The facility is provided with a 2-ton packaged window type A/C unit and a 1-ton water cooled floor type packaged A/C unit. The facility is also supplemented with approximately 1,200 cfm of 60°F air through two 12-inch flexible ducts tapped from the central air handling unit that is providing general cooling for the Upper Exhaust Tunnel.

Observed Room Conditions

Microwave Facility	74° FDB	61°F WB	48% RH
Upper Tunnel	72° FDB	60°F WB	50% RH

3.6.2 Domestic Hot Water System

Not applicable. The facility does not have any domestic hot water.

3.6.3 Lighting System

Existing lighting is fluorescent and is operating continuously. The connected lighting load is approximately 1.2 KW. Existing lighting level measured did not exceed DOD criteria. Measured and required lighting levels are as follows:

Area	Required FC	Actual FC	Fixture Type	Qty	Mounting Height
Microwave Fac.	50	30 - 45	Fluor-Surface 2'x 4'	4	8'- 0"

3.6.4 Recommended ECO's for Analysis

A. Convert to a chilled water system by replacing existing A/C equipment with two chilled water fan-coil units connecting to the central chilled water system (ECO M-2).

3.6.5 Recommended ECO's for Maintenance Items

A. Turn off the lighting when the space is not occupied by operating personnel.

B. Replace all burnt out fluorescent lamps and ballasts with an energy saving type in areas not marginally illuminated. Clean diffusers prior to relamping.

3.7 DOMESTIC HOT WATER SYSTEM

3.7.1 Central Hot Water System

The facility is provided with a central domestic hot water generating system located in the A/C Plant and with distribution piping to toilets and kitchens. The system includes the following equipment:

Oil Fired Hot Water Heater - Out of order.

Liquid Chiller - Acting as a water to water heat pump.

Model: CARRIER, 30 HM 070D600-4

Compressors: #1 and #2, 33 amps RLA, 173 amps LRA
#3, 49 amps RLA, 253 amps LRA

H.W. Storage Tank

Horizontal Type, Capacity - 3,350 gal.

Circulating Pump

Model: Armstrong 2B100AB

Capacity: 70 gpm @ 20 ft. head

Motor: 1 HP, 220/240V

The liquid chiller (30 tons) is operating as a water to water heat pump and supplies most of the required hot water demands. The liquid chiller was operating under the following conditions:

Ambient Condition:	80°F DB, 68°F WB
H.W. Supply Temp.:	156°F @ 80 psi
H.W. Return Temp.:	152°F @ 80 psi
Cond. Water Supply Temp.:	80°F @ 19 psi
Cond. Water Return Temp.:	82°F @ 15 psi
Temp. Controller setting:	140°F

Note: At the time of survey, only Compressor #1 of the chiller was operating.

3.7.2 Individual Electric Water Heaters

At four (4) different locations that are remote from the Central Hot Water System, individual electric water heaters are provided to supply localized demands (see Figures 1-2, 1-3, and 1-4). The following are the description of the heaters:

EWH #1 (1st Floor)

Model: STATE, PV-40

Capacity: 40 gallons

Elements: Upper 2.5 KW, Lower 2.5 KW, 240V

Operating H.W. Temp: 125°F

EWH #2 (2nd Floor)

Model: NATIONAL, AR-100

Capacity: 100 gallons

Elements: Upper 5 KW, Lower 5 KW, 240V

Operating H.W. Temp: 120°F

EWH #3 (2nd Floor)

Model: STATE, PV-40

Capacity: 40 gallons

Elements: Upper 2.5 KW, Lower 2.5 KW, 240V

Operating H.W. Temp: 120°F

EWH #4 (A/C Plant)

Model: STATE, PV-82

Capacity: 82 gallons

Elements: Upper 2.5 KW, Lower 2.5 KW, 240V

Operating H.W. Temp: 130°F

3.7.3 Recommended ECO's for ECIP Analysis

A. Remove the existing electric water heaters (4 each) and connect the system to the central hot water system (ECO M-3).

3.7.4 Recommended ECO's for Maintenance Items

A. Reset the thermostats of electric water heaters at 120°F.

3.8 UNDERGROUND VENTILATION SYSTEM

Since the facility is entirely underground, the ventilation system is very critical for the facility operation and health of personnel. The system is also energy intensive due to the fact that a large volume of supply and exhaust air is distributed through extensive duct work.

The existing ventilation system is comprised of supply air (outside air), building exhaust air, and kitchen exhaust air systems.

3.8.1 Supply Air System

For the supply of outside air required for the occupants and make-up of kitchen and building exhaust air, the facility is provided with a large supply air system. The system includes the following features:

A. Outside Air Intake Structure

A remotely located concrete structure to intake the required outside air from atmosphere.

B. Outside Air Intake Tunnel

An underground concrete tunnel interconnecting the outside air intake structure and the Kunia Field Station. The tunnel serves as a conduit for outside air movement.

C. Air Filter Bank

Fifty (50) each of 20" x 20" x 2" thick air filters to remove impurities from the supply air.

D. Chemical Filters:

Ten (10) each of 5,000 cfm chemical filter units with booster fans for the protection of chemical warfare, normally bypassed.

E. Supply Air Fans

Four (4) each of 30,000 cfm centrifugal fans to draw the required outside air through the intake structure and distribute the air to various locations as required through the duct work. Normally one fan is in operation and the rest of the fans are redundant.

F. Air Distribution Ducts

To distribute the required supply air to the various locations in the facility. Most of the air is supplied through air handling units except directly to the space for the kitchen ventilation.

3.8.2 Building Exhaust air System

For the exhaust of air from various spaces, the facility is provided with an extensive building exhaust air system. The system includes the following features:

A. Exhaust Air Ducts

To collect the required exhaust air from various spaces to the exhaust fan.

B. Exhaust Fan

One (1) each of 40,000 cfm variable speed centrifugal fan to move exhaust air from the spaces to the exhaust tunnel. Normally, it is operating at approximately 26,000 cfm range.

C. Exhaust Tunnel

A double deck concrete tunnel conveying the exhaust air to the exhaust structure. The tunnel also houses the kitchen exhaust duct and various water pipings.

D. Exhaust Structure

A remotely located concrete structure to discharge the exhaust air and protect the facility from any exterior blast.

3.8.3 Kitchen Exhaust Air System

For the kitchen ventilation, a separate kitchen exhaust system is provided. The system includes the following features:

A. Kitchen Hoods

To collect kitchen exhaust air and to remove grease from the exhaust air.

B. Kitchen Exhaust Fan

One (1) each of 13,400 cfm centrifugal fan to move kitchen exhaust air from the hoods to the exhaust structure.

C. Kitchen Exhaust Duct

A separate duct work to convey kitchen exhaust air from the fan to the exhaust structure. It runs through the lower deck of the exhaust tunnel.

3.8.4 Proposed Modifications

Under the contract with Mechanical Engineer of Hawaii Corporation, the following modifications are proposed to the existing ventilation system (see Figure 3-1):

A. Existing supply fans (4 each of 30,000 cfm) will be replaced with new fans (4 each of 20,560 cfm, variable speed).

B. An additional exhaust fan (36,300 cfm, variable speed) will be installed for redundancy.

C. New cooling coils (total cooling capacity 1,412 MBTUH with 41,120 cfm) will be installed in the intake tunnel to precool the supply air for humidity control.

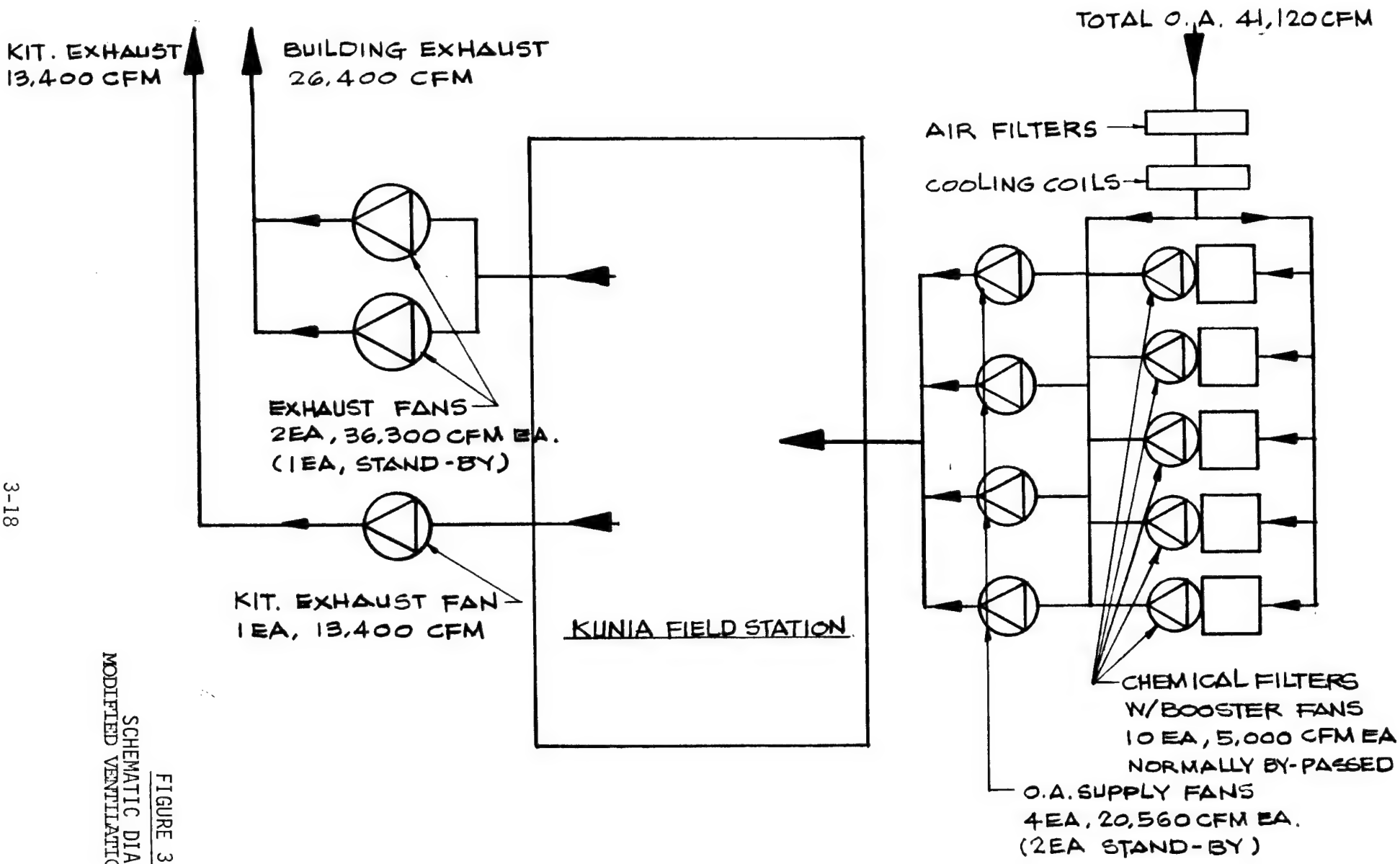
D. The resulted air balance will be as follows:

Building Exhaust Air	=	26,400 cfm
Kitchen Exhaust Air	=	13,400 cfm
Total Exhaust Air	=	39,800 cfm
Total Supply Air	=	41,120 cfm
Excess Air for Pressurization	=	1,320 cfm

3.8.5 Recommended ECO's for Analysis

A. Timeclock control for the kitchen exhaust system with a motorized damper control on the make-up air system (ECO M-4).

B. Since the temperature differential between the exhaust air (72°F) and the supply air (76°F) is insignificant (4°F), no energy recovery ECO is feasible to precool the supply air.



SCHEMATIC DIAGRAM OF VENTILATION SYSTEM
EXISTING SYSTEM WITH PROPOSED MODIFICATIONS

FIGURE 3-1
SCHEMATIC DIAGRAM OF
MODIFIED VENTILATION SYSTEM

3.8.6 Recommended ECO's for Maintenance Items

A. None

3.9 ENTRANCE TUNNEL

The facility is provided with a long entrance tunnel (approximately 1,200 feet) for the purpose of security and blast protection (See Figure 1-1).

3.9.1 Ventilation System

The tunnel is provided with a forced ventilation system for the removal of vehicle exhaust fumes (See Figure 3-2). The system includes the following features:

A. Air Intake and Exhaust Tunnel

For the blast protection, concrete air intake and exhaust tunnels with blast-valves are provided for the entrance tunnel ventilation system.

B. Supply Fans

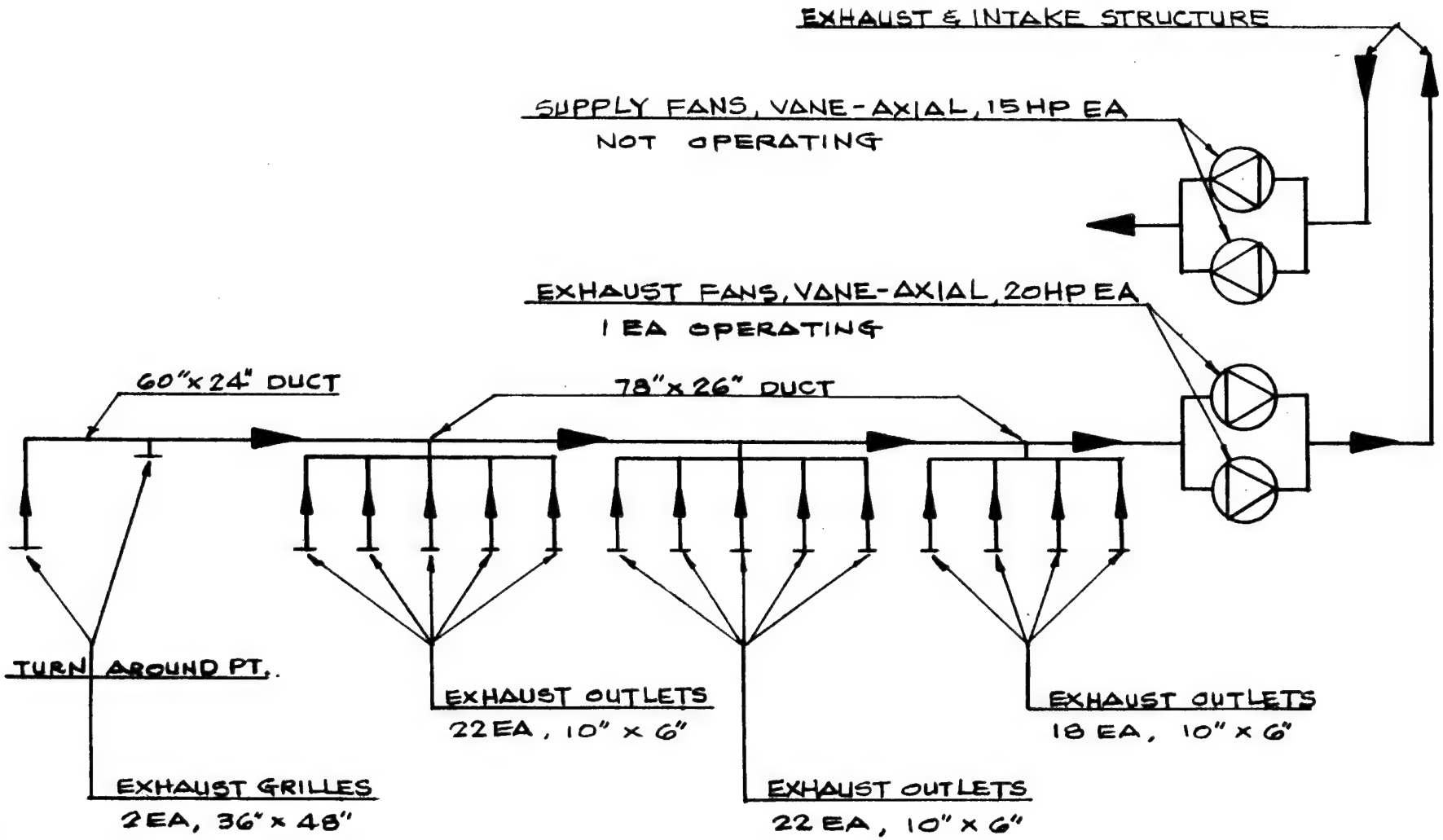
Two (2) each of 28,100 cfm vane-axial fans, located in the mezzanine of the entrance structure. The supply air is to be drawn through the intake tunnel and discharged to the tunnel at the upper portion of the entrance structure. The fans are not operating.

C. Exhaust Fans

Two (2) each of 28,100 cfm vane-axial fans, located in the mezzanine of the entrance structure. One fan is operating and the other fan is redundant. The exhaust air is collected through the duct work and discharged to the exterior through the exhaust tunnel.

D. Exhaust Duct Work

An extensive exhaust duct work is provided to collect the exhaust air throughout the entrance tunnel. The collection system starts with two 36" x 48" exhaust grilles one at the floor level and the



SCHEMATIC DIAGRAM OF ENTRANCE TUNNEL VENTILATION SYSTEM

FIGURE 3-2
SCHEMATIC DIAGRAM OF ENTRANCE TUNNEL VENTILATION SYSTEM

other at the ceiling level of the turnaround point. The main exhaust duct runs along the tunnel ceiling with 62 each of 10" x 6" exhaust outlets extended down both sides of the tunnel walls to near floor level. The branch ducts are spaced at 30-foot intervals.

3.9.2 Lighting System

Existing lighting is high pressure sodium (HPS) wall pack type fixtures located along the northwest wall. All fixtures operate 24 hours per day except for units on exterior wall of tunnel entrance which are time-switch controlled.

Total connected lighting load is approximately 6.4 KW. Existing lighting levels measured did not exceed DOD criteria. Measured and required lighting levels are as follows:

Area	Required FC	Actual FC	Fixture Type	Qty	Mounting Height
General Illumination	5	2 - 5	HPS-Wall Pack	24	14'-0"

3.9.3 Deficiencies of Ventilation System

The system design was intended to exhaust 600 cfm air per 30-foot section of tunnel through 2 each of 10" x 6" outlets and approximately 9,500 cfm at the turnaround area which is the innermost point of the tunnel. The field survey revealed that the air outlets near the tunnel entrance showed strong suction but a gradual decline ensued upon entering further into the tunnel towards the turnaround point. This poor exhaust condition at the turnaround point coupled with the turnaround point being the area of maximum accumulation of vehicular exhaust fumes, results in a health hazard to personnel. See APPENDIX B for the analysis of the existing system. The main reason for this deficiency is interpreted as the existing vane-axial exhaust fans are not capable to produce required static pressure.

3.9.4 Recommended ECO's for ECIP Analysis:

A. Replace the existing vane-axial exhaust fans with in-line centrifugal fans (ECO M-5).

B. Entrance tunnel light fixtures are energy efficient high pressure sodium. No ECO is applicable.

3.9.5 Recommended ECO's for Maintenance Items

A. Close the first 40 air outlets from the tunnel entrance to improve the exhaust system at the turnaround point.

3.10 EXTERIOR LIGHTING SYSTEM

3.10.1 Parking Area

Existing lighting is high pressure sodium (HPS) on time-switch control. Twin-flooding type fixtures are provided around the entire perimeter of parking area, with roadway single and twin-luminaries used between parking stall sectors. Cobra-head roadway luminaries illuminate Access Road (bordering parking area), from Security Booth to Tunnel Entrance. HPS units are part of a recent renovation to initially installed mercury vapor luminaries.

Few mercury vapor fixtures remaining in parking stall area are disconnected in-place by the base electrician. Total connected lighting load is approximately 39.0 KW.

3.10.2 Upper Fenced Area

Existing lighting is incandescent for security area illumination with fluorescent and HID fixtures provided for selected areas near equipment.

Three-lamp fixtures provided along perimeter fence used recently replaced energy saving, lower wattage tungsten halogen lamps (part of on-going in-house energy conservation program). Photo switch control is used for fence lighting.

The perimeter fence is scheduled to be renovated under CE-POD Project FY88 OMA Package A-6, at which time incandescent flood lights will be replaced with energy efficient fixtures by government security personnel. Fluorescent fixtures located at cooling towers are locally switched.

Total connected lighting load is approximately 9.5 KW.

3.10.3 Recommended ECO's for ECIP Analysis

A. Replace incandescent fixtures along the perimeter fence with high pressure sodium fixtures (ECO E-5).

B. Parking area light fixtures are energy efficient high pressure sodium type. No ECO is applicable.

C. Parking area lighting is time-switch controlled. No ECO is applicable.

3.10.4 Recommended ECO's for Maintenance Items

A. Replace all burnt out fluorescent lamps and ballasts with an energy saving type in areas not marginally illuminated. Clean diffusers prior to relamping.

3.11 ENERGY CONSUMPTION RECORD

The energy consumption of the facility for the last seventeen months is shown on Table 3-1 and Figures 3-3 through 3-6.

TABLE 3-1

ENERGY CONSUMPTION RECORD

YEAR	MONTH	KWH	$	$/KWH
1986	OCTOBER	928,000	43,243.47	0.047
	NOVEMBER	1,008,000	45,923.36	0.046
	DECEMBER	964,000	48,398.92	0.050
1987	JANUARY	1,072,000	51,750.00	0.048
	FEBRUARY	836,000	45,377.12	0.054
	MARCH	936,000	52,138.13	0.056
	APRIL	904,000	56,206.43	0.062
	MAY	1,000,000	60,932.05	0.061
	JUNE	856,000	53,299.81	0.062
	JULY	1,104,000	65,938.59	0.060
	AUGUST	1,136,000	68,113.85	0.060
	SEPTEMBER	1,256,000	75,334.56	0.060
FY1987	TOTAL	12,000,000	666,656.29	0.056
1987	OCTOBER	1,072,000	68,909.10	0.064
	NOVEMBER	1,092,000	69,597.71	0.064
	DECEMBER	1,132,000	68,805.90	0.061
1988	JANUARY	804,000	54,314.06	0.068
	FEBRUARY	1,092,000	66,703.60	0.061
FY1988	TOTAL	5,192,000	328,330.37	0.063

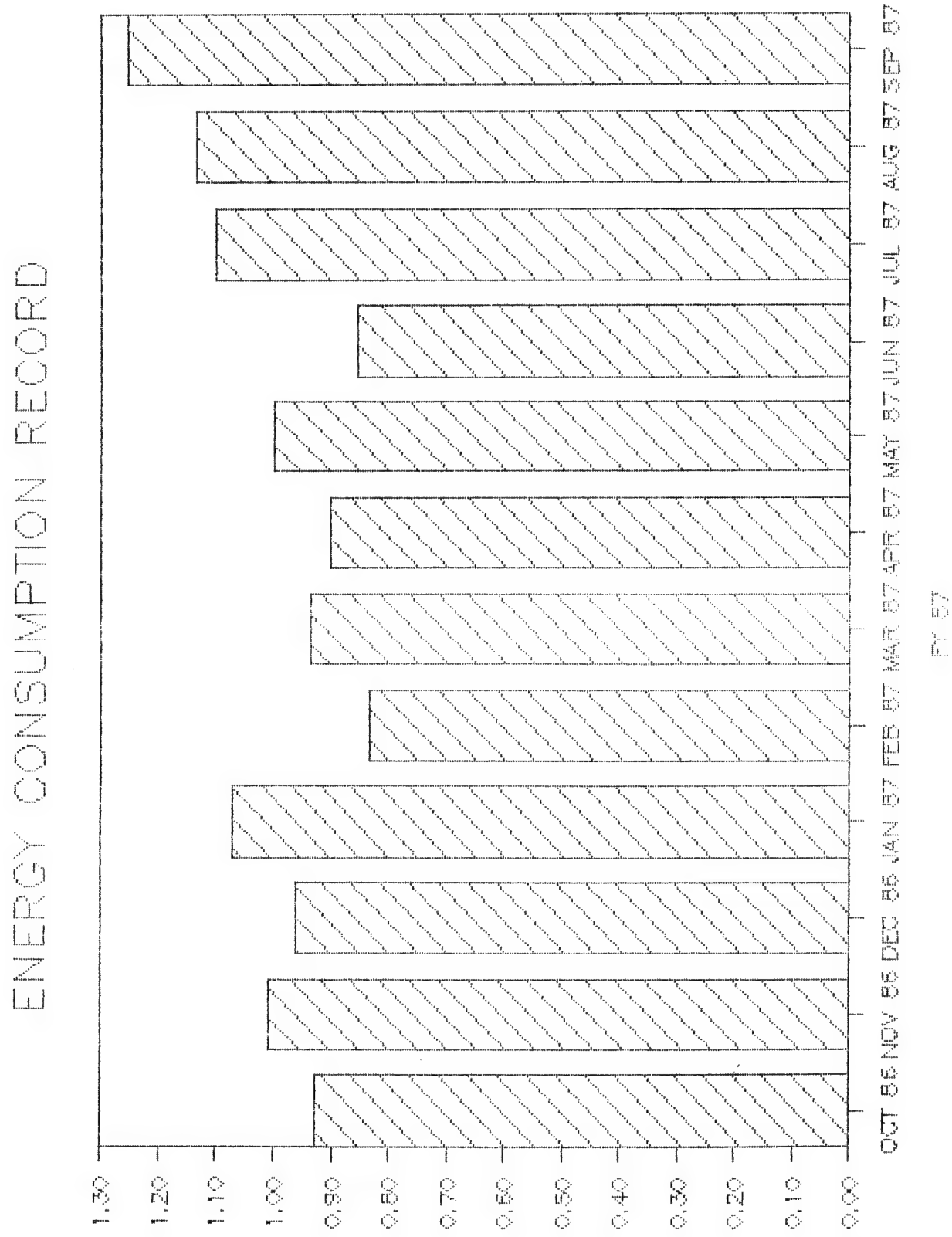


FIGURE 3-3

ENERGY CONSUMPTION RECORD

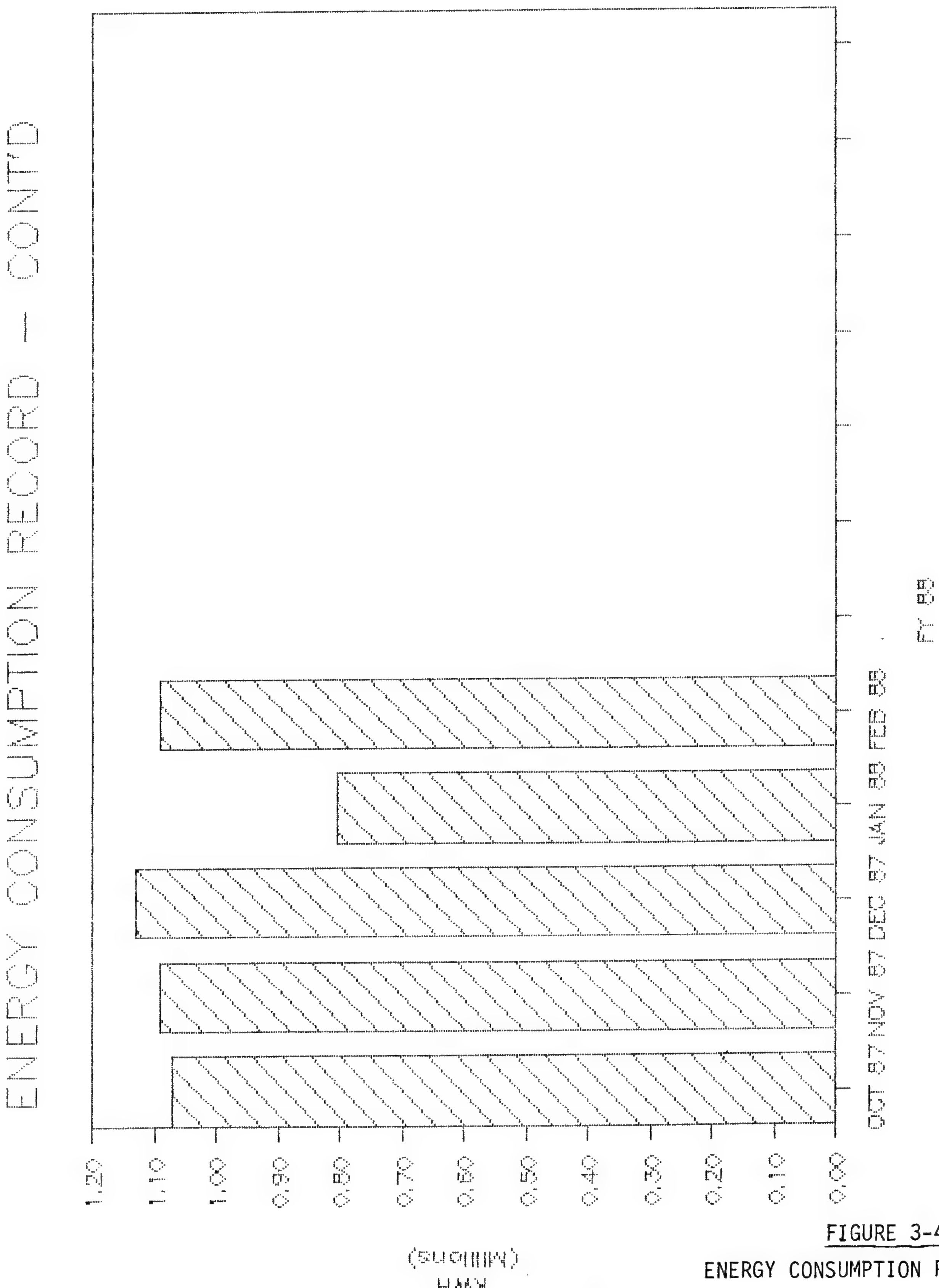


FIGURE 3-4

ENERGY CONSUMPTION RECORD

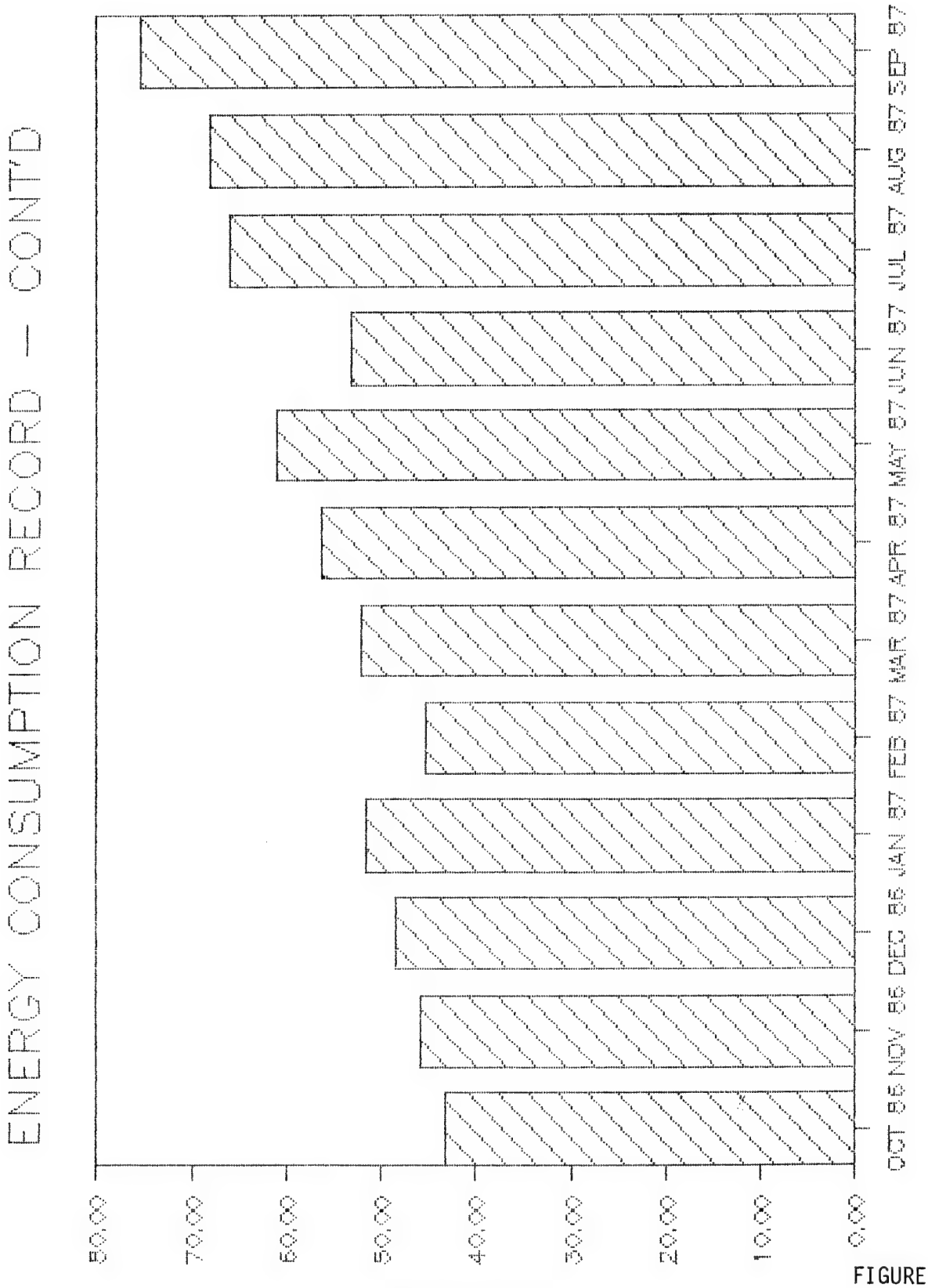


FIGURE 3-5

ENERGY CONSUMPTION RECORD

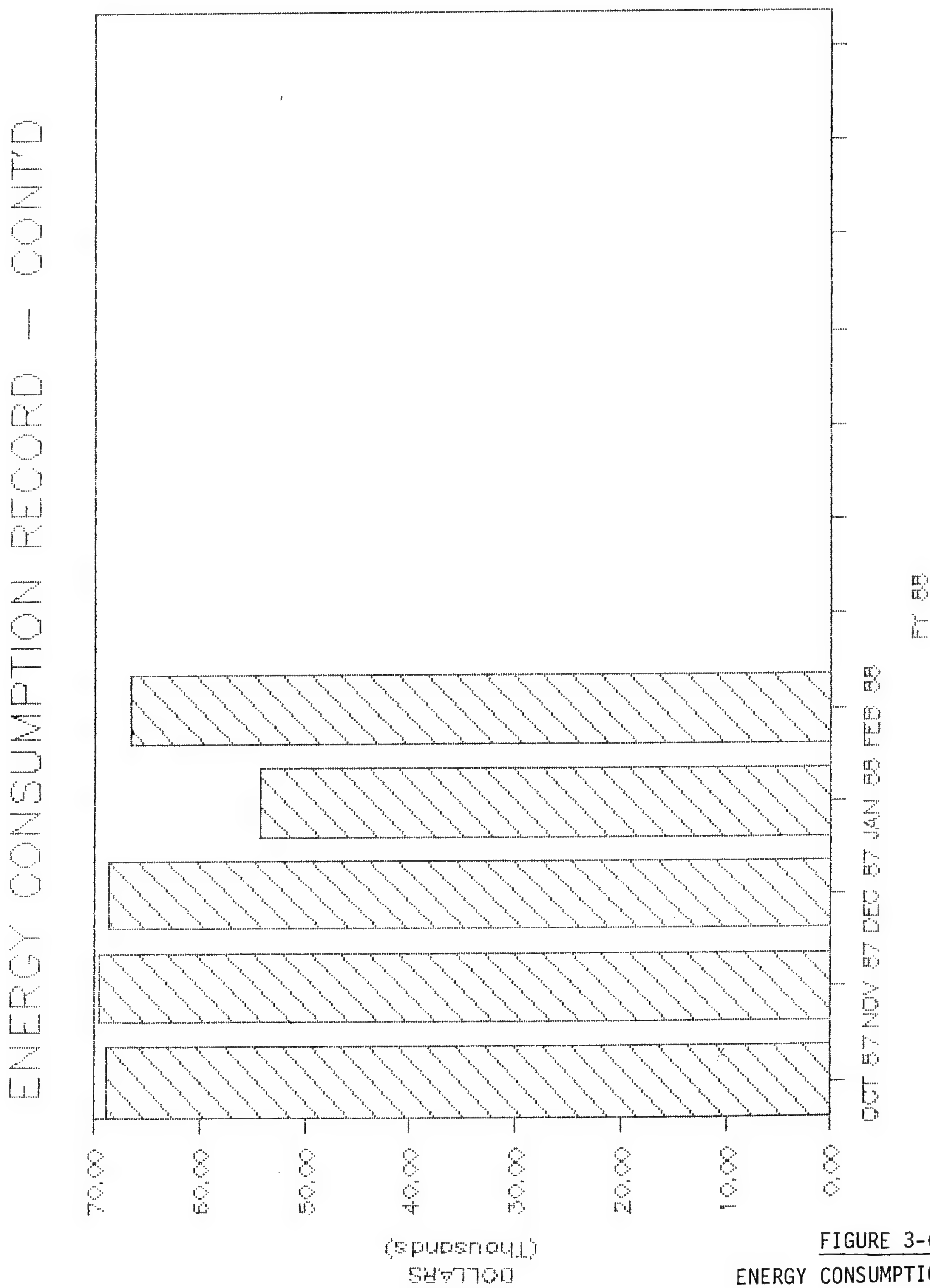


FIGURE 3-6

ENERGY CONSUMPTION RECORD

CHAPTER 4
BUILDING ENERGY CONSERVATION OPPORTUNITIES

4.1 GENERAL

This chapter describes the applicable ECO's which were identified and evaluated for the areas covered under this study. The text was taken from ANNEX A GENERAL ENERGY CONSERVATION OPPORTUNITIES provided under the Scope of Work.

Applicable ECO's are to be analyzed for their feasibility, and feasible ECO's are to be developed into projects and implemented under ECIP or other programs.

Some applicable ECO's are recommended for Maintenance Items which could be implemented in a short time by installation maintenance personnel using regular maintenance and repair funds, and without the need for a time consuming project programming process. This assumes that sufficient maintenance manpower and funds are available to accomplish the tasks with priority given to energy conservation projects.

4.2 APPLICABLE ENERGY CONSERVATION OPPORTUNITIES

In this section, applicable ECO's which were considered for the facility are described. Those ECO's which were analyzed are listed under each individual area in CHAPTER 3.

4.2.1 Architectural ECO's

Since the facility is an underground structure, no heat gain or loss related with the building envelope is involved, therefore, no architectural ECO's are applicable.

4.2.2 Mechanical ECO's

Mechanical ECO's can affect the energy consumption by controlling the environmental conditions within the space such as the temperature gradient. Mechanical ECO's can also include the replacement of mechanical equipment

with more efficient equipment and hence improve the operation of mechanical systems including domestic hot water heating, space cooling, and ventilation.

A. Time Clock Controls for Air Conditioning and Ventilation Systems

Time clock controls limit the operation of A/C and ventilation systems to preset hours. Although the facility is basically under 24-hour operation all year around, careful application of time clocks to selected A/C and ventilation systems contributes to substantial energy savings. It is important, therefore, that the on-off settings be carefully selected to reasonable hours so that the A/C and ventilation systems do not run unnecessarily. The bypass timer is recommended for the time clock control to accommodate occasional use of the systems out of the normal operating hours.

B. Reduction of Outside Air

The facility requires a large volume of outside air for the makeup of exhaust air required for occupant health and equipment operation. The reduction of outside air is not only to save the energy required for fan operation, but to also reduce the energy to precool the outside air for the humidity control which is proposed under the project, PN173 A/C Upgrade.

C. Consolidation of Domestic Hot Water System

Central domestic hot water is generated by a water-to-water heat pump installed in the A/C plant. By reconnecting the remote domestic hot water systems currently supplied by electric water heaters, to the central hot water system, energy would be reduced substantially because of the higher efficiency of the heat pump.

D. More Efficient Exhaust Fans

The existing vane-axial exhaust fans provided for the entrance tunnel are operating at less than one-third capacity of the

intended design. Replacing the existing vane-axial fans with in-line centrifugal fans not only improves the ventilation but also saves fan energy, because of better efficiency at higher static pressures.

4.2.3 Electrical ECO's

A. Lighting Systems

The development of energy efficient lamps, fixtures and ballasts has made it desirable and feasible in many cases to replace existing lights with the energy saving counterparts. The energy efficient replacements produce the same or even more light for less electrical energy input and often allowing a reduction in the number of fixtures. In this manner, substantial savings are realized from the lower electrical energy consumption by lighting that offers high returns on investments.

However attractive energy savings may appear, the quality of lighting cannot be compromised to substandard levels. Besides recommended foot-candle standards, other quality factors such as lamp color, fixture appearance, suitability, mounting and positioning must be considered. On the other hand, performance factors such as replacement cost, operating cost, lamp life and fixture hum cannot be ignored. In spite of all these considerations, energy savings can still be achieved without sacrificing the quality.

B. Replace Existing Incandescent Fixtures With Fluorescent Fixtures

Because of the higher efficiency and extended life of fluorescent lamps as compared to incandescent lamps, the life cycle cost analysis (Appendix B) usually results in a SIR greater than 1.0 unless the annual hours of lamp usage is very low. Considerable maintenance savings also accrue because fluorescent lamps require much less replacement than incandescent lamps.

C. Replace Existing Incandescent Fixtures With High Pressure Sodium Fixtures

High pressure sodium (HPS) lamps, compared to incandescent lamps, are much more efficient and have extremely long life times (24,000 hours), but their installation cost is relatively high. The number of annual lamp-hours is a significant determinant of the feasibility of HPS retrofits because the high cost of HPS lamps (about $50 for 35-watt size) relative to incandescent lamps ($1 to $25, depending on size and type) partially offsets the labor savings of fewer lamp replacements per year. Higher lamp-hours mean more incandescent lamp changes, increasing the advantage of HPS fixtures.

4.2.4 Maintenance Items

Some applicable ECO's which can be implemented by installation maintenance personnel using regular maintenance and repair funds are classified as Maintenance Items. The following is the list of ECO's recommended as Maintenance Items:

A. Resetting thermostats at proper temperature.
B. Replace burnt out fluorescent lamps and ballasts with an energy saving type in areas not marginally illuminated. Clean diffusers prior to relamping.
C. Delamp fluorescent fixtures where the lighting level is excessive.
D. Turn off unnecessary lighting and exhaust fans.
E. Block off some exhaust outlets of the entrance tunnel.

Maintenance items recommended for each designated area are listed in CHAPTER 3.

4.3 INAPPLICABLE ENERGY CONSERVATION OPPORTUNITIES

The following suggested ECO's listed in Annex A of the Contract Scope of Work are inapplicable to the facility covered in this study and their reasons are:

A. Building Insulation - Not applicable to the facility as it is an underground structure.

B. Storm Windows or Double Glazing - Not applicable for the same reason as item A.

C. Weatherstripping and Caulking - Not applicable for the same reason as item A.

D. Insulated Panels - Not applicable for the same reason as item A.

E. Solar Films - Not applicable for the same reason as item A.

F. Vestibules - Not applicable as no vestibules are involved

G. Load Dock Seals - Not applicable as no loading docks are involved.

H. Reduction of Glass Area - Not applicable for the same reason as item A.

I. Replace Kitchen Light Fixtures - Not applicable as existing kitchen fixtures are energy efficient fluorescent.

J. Shutdown Energy to H.W. Heaters - Not applicable as the facility is in operation for 24 hours daily.

K. Improve Power Factor - It is not in the scope as this study is limited to the designated areas only.

L. High Efficiency Motor Replacement - It is not applicable as all motors will be replaced under Project PN173, A/C Upgrade.

M. Night Setback/Setup Thermostats - It is not applicable as the facility is in operation for 24 hours daily.

N. Infrared Heaters - Not applicable for no heating is involved.

O. Economizer Cycles - Utilization of outside air for space cooling is not practical because of the warm humid climate. The temperature and humidity are very high during the operational period of the facility.

P. Control Hot Water Circulation Pump - Not applicable as no heating is involved.

Q. FM Radio Controls - Not applicable as the facility is a single underground facility.

R. Radiator Controls - Not applicable as no radiator is involved.

S. Decentralize Domestic Hot Water Heaters - It is more energy efficient to have the central system utilize the heat pump rather than individual electric water heaters.

T. Install Shower Flow Restrictors - It is not in the scope as no shower facility is involved.

U. Heat Reclaim from Hot Refrigerant Gas - It is not applicable as the chiller plant is not included in the scope.

V. Prevent Air Stratification - Generally not a problem in air conditioned spaces, because the volume of supply air and the manner of its distribution ensures good vertical circulation.

W. Boiler Oxygen Trim Control - It is not applicable as no boiler is involved.

X. Revise Boiler Control - It is not applicable as no boiler is involved.

Y. Chiller Replacement - This is not in the scope.

Z. Replace Absorption Chiller - It is not applicable as no absorption chiller is involved.

AA. Chiller Controls - It is not in the scope.

BB. Insulate Steam and Condensate Lines - It is not applicable as no steam and condensate lines are involved.

CC. Return Condensate - It is not applicable as no condensate is involved.

DD. Heat Reclaim from Family Housing Condenser Units - It is not applicable as no family housing is involved.

EE. Transformer Over-Voltage and Loading - It is not in the scope.

FF. Reduce Air Flow - All A/C systems are constant air volume systems and no energy savings are expected by reducing air flow.

GG. Waste Heat Recovery - It is not feasible as the temperature difference is insignificant.

HH. Thermal Storage - It is not applicable as no discounted power cost is available.

II. Steam Trap Inspection - It is not applicable as no steam trap is involved.

JJ. Instantaneous Hot Water Heater - It is not applicable as H.W. must be continually circulated.

KK. Air Curtains - It is not applicable as the facility is pressurized to eliminate the infiltration.

LL. Occupancy Sensors to Control HVAC - This ECO is applicable only to single private room with its own system. The A/C systems for the facility include multiple rooms of various functions, therefore, this ECO is inapplicable. The time clock control is more suitable for this application.

MM. Occupancy Sensors to Control Lighting - The use of occupancy sensors to control lights for facilities involved in this study is not feasible for the following reasons:

1. The facility currently practice energy conservation by turning off lights for rooms not in use.

2. For smaller rooms, replacement of wall toggle switch with motion sensor switch cannot be justified unless the occupant frequently forgets to turn off the light several nights per week.

3. Many large rooms have interior partitions that would require several motion sensors and relays resulting in substantially higher initial cost.

4. Location of switches must be carefully selected to avoid direct light sources (for infrared type), minimize dead spots which may cause lights to turn off when occupants are present, etc.

4.4 SPECIAL MAINTENANCE ITEM

Annex B, item 1c under the project scope of work requires the analysis for the possibility of using more efficient entrance tunnel exhaust system. The nature of required analysis is more related to the problem of health hazards rather than energy conservation. However, for the improvement of tunnel ventilation system, the present operation is analyzed and improvement recommendations are included in Appendix B.

CHAPTER 5
BUILDING ENERGY END-USE ANALYSIS

5.1 ENERGY END-USE ANALYSIS

The purpose of the energy end-use analysis is to estimate the existing building energy consumption to use as a baseline for calculating the energy savings from ECO's. This energy baseline is a station-wide look at the present energy consumption as opposed to the specific energy consumption of each system calculated in Appendix B. The intent is to compare the energy savings to both the systems being evaluated as well as the entire facility inclusive of all systems. The station's energy use is broken down into the following end-use categories:

- Air Conditioning
- Lighting
- Domestic Hot Water
- Other Electric Equipment

Electricity is the single source of energy for this facility.

Each end-use category will be calculated individually and then summarized for comparison to the energy savings.

5.2 AIR CONDITIONING ENERGY

Air conditioning energy requirements are calculated using an in-house computer program of the Bin Method (Reference ASHRAE Fundamentals 1985, Chapter 28). The Bin Method involves first making an instantaneous cooling load (Heat Gain) calculation for the annual design maximum hour for the facility. The power input to the air conditioning equipment at the design maximum load depends upon the particular type of air conditioning system. The power inputs used in the calculations are listed in Table 5-1. The load profile is estimated by linear interpolation using the known indoor and outdoor design conditions as end points for no-load and full-load operation. The part-load power input is then weighted by the annual hours of occurrence in each temperature bin to yield the equivalent full-load hours of air conditioning operation. The annual equivalent full-load hours are obtained by summing all the temperature bins.

TABLE 5-1

ASSUMED POWER INPUTS TO COOLING SYSTEMS

System Type Description	POWER REQUIREMENT (KW/TON) Compressor	Auxiliaries[1]	Total
Window Units	1.46	0.32	1.78
Central, Air-Cooled (for Dwelling Unit)	1.49	0.14	1.63
Through-Wall Units	1.64	0.30	1.94
Air-Cooled, 3 to 25 Tons	1.20	0.20	1.40
Air-Cooled, 25 to 100 Tons	1.18	0.21	1.39
Water-Cooled, 25 to 100 Tons	0.94	0.17	1.11
Water-Cooled, Over 100 Tons	0.79	0.20	0.99

Reference: ASHRAE 1985 Fundamentals Handbook, Table 2, Chapter 28.

NOTES: [1]"Auxiliaries" include (where applicable): circulating pumps, condenser fans, and cooling tower fans. For central plants, air-handling unit power consumption is separately estimated to be 0.4 KW per 1,000 CFM of supply air. The total supply air quantity is obtained from Mechanical Engineers of Hawaii.

Multiplying the full load power input by the equivalent annual full load hours and the design maximum cooling load, equals the estimated annual energy consumption, i.e.:

Air-Conditioning Plant:

Annual Energy (KWH)	=	Full-Load Power Input (KW/Ton)	X	Equivalent Annual Full-Load Hours	X	Design Maximum Cooling Load (Tons)	(Equa. 5-1a)

The calculation to determine the annual equivalent full-load hours for the facility is tabulated. The Engineering Weather Data (TM 5-785) manual is the source of outdoor air temperature for the equivalent full-load hour calculation. The full-load hours are calculated for 24-hour operation of air conditioning, and adjusted according to the actual daily hours of operation of the facility. For Kunia Field Station, the full-load hours extends over the entire 24-hour period.

Energy used by auxiliary cooling plant systems (i.e., condenser fans or cooling tower fans, and circulating pumps) is similarly calculated, but using the estimated annual A/C system operating hours rather than the equivalent full-load hours:

Air-Conditioning Plant (Auxiliaries):

Annual Energy (KWH)	=	Full-Load Power Input (KW/Ton)	X	Annual Operating Hours	X	Design Maximum Cooling Load (Tons)	(Equa. 5-1b)

Energy used by air handling units is similarly calculated, using the known supply air volume and an estimated fan power consumption of 0.4 kilowatts per 1,000 cfm:

Air-Handling Units:

Annual Energy (KWH)	=	Full-Load Power Input (KW/CFM)	X	System Operating Hours	X	Design Supply Air Volume (CFM)	(Equa. 5-1c)

The following are the full-load hour profile, lighting profile, occupant profile, and finally, the air conditioning analysis of the Kunia Field Station.

ANNUAL FULL LOAD HOURS WEATHER DATA REF.: TM 5-785

BUILDING: U.S.ARMY FIELD STATION
LOCATION: KUNIA, HAWAII

COOLING SEASON - ALL YEAR, BARBER'S POINT NAVAL AIR STATION

TEMP RANGE	01-08	09-16	17-24	TOTAL	% OF MAX. LOAD
95-99	0	0	0	0	0
90-94	0	1	0	1	1.00
85-89	0	219	14	233	1.00
80-84	19	1332	364	1715	0.60
75-79	550	1036	1205	2791	0.20
70-74	1492	290	1035	2817	0
65-69	710	39	273	1022	0
60-64	129	2	22	153	0
55-59	16	0	2	18	0
50-54	2	0	0	2	0
45-49	0	0	0	0	0
TOTAL HRS	2918	2919	2915	8752	

24 HRS/7 DAYS/WK

FULL LOAD HRS	121	1226	473	1820
OPERATING HRS	2918	2919	2915	8752

ADJUST TO KUNIA STATION FROM BARBER'S PT. NAS
USE RATIO OF ANNUAL COOLING DEGREE DAYS: (2821/3929) = 0.72

ADJUSTED FULL LOAD HRS	87	883	341	1311
OPERATING HRS	2918	2919	2919	8752

EXISTING: 24 HRS/7 DAYS/WK

FULL LOAD HRS	1311
OPERATING HRS	8752

ENERGY ENGINEERING ANALYSIS - LIGHTING PROFILE

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: ENTIRE STATION

ECO NAME: ENERGY END-USE ANALYSIS
CONDITION: EXISTING

MAXIMUM LIGHTING LOAD: 591.6 KW

FRACTION OF MAXIMUM (0.0 - 1.00)								
HOUR	SUN]	MON	TUE	WED	THU	FRI	SAT	HOLIDAY
1	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
2	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
3	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
4	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
6	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
11	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
12	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
13	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
14	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
16	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
17	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
18	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
19	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
20	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
21	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
22	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
23	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
24	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
TOTAL	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2

TOTAL PER UNIT KW HOUR/WEEK 148.4 HRS/WK
TOTAL PER UNIT KW HOUR/YEAR 7,717 HRS/YR

ENERGY ENGINEERING ANALYSIS - OCCUPANT PROFILE

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: ENTIRE STATION

ECO NAME: ENERGY END-USE ANALYSIS
CONDITION: EXISTING

MAXIMUM NUMBER OF OCCUPANTS: 1,000

	FRACTION OF MAXIMUM (0.0 - 1.00)							
HOUR	SUN	MON	TUE	WED	THU	FRI	SAT	HOLIDAY
1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
7	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.3
8	0.4	0.6	0.6	0.6	0.6	0.6	0.4	0.4
9	0.4	0.8	0.8	0.8	0.8	0.8	0.4	0.4
10	0.4	0.8	0.8	0.8	0.8	0.8	0.4	0.4
11	0.4	0.8	0.8	0.8	0.8	0.8	0.4	0.4
12	0.4	1.0	1.0	1.0	1.0	1.0	0.4	0.4
13	0.4	1.0	1.0	1.0	1.0	1.0	0.4	0.4
14	0.4	1.0	1.0	1.0	1.0	1.0	0.4	0.4
15	0.4	0.8	0.8	0.8	0.8	0.8	0.4	0.4
16	0.4	0.6	0.6	0.6	0.6	0.6	0.4	0.4
17	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
18	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
19	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
20	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
21	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
22	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
23	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
24	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
TOTAL	7.0	10.9	10.9	10.9	10.9	10.9	7.0	7.0

TOTAL OCCUPANT HOUR/WEEK: 68.5 HRS/WK
TOTAL OCCUPANT HOUR/YEAR: 3,562 HRS/YR

AIR CONDITIONING ENERGY ANALYSIS

KUNIA FIELD STA. AREA: ENTIRE STATION
EXISTING CONDITION: ENERGY END-USE ANALYSIS

NUMBER OF STORIES	=	3	WINDOW U-FACTOR =	0	BTUH/SF-F
TOTAL FLOOR AREA	=	232,500 SF	HUMAN HEAT GAIN =	640	BTUH/OCC.
AIR-CONDITIONED AREA	=	197,200 SF	OUTSIDE AIR =	41,120	CFM
NO. OF OCCUPANTS	=	1,000	LIGHTING LOAD =	591.60	KW
INSIDE TEMPERATURE	=	75 F	EQUIPMENT LOAD =	394.40	KW
CONDITIONED VOLUME	=	1,972,000 CF			

ORIENTATION	NET WALL AREA (SF)	U	WINDOW AREA (SF)	SHADE FACTOR	EXTERIOR SURFACE HEAT TRANSFER PARAMETERS CLTD (DEG F)	SHGF (BTUH/SF)
N	0	0.00	0	0	0	0
S	0	0.00	0	0	0	0
E	0	0.00	0	0	0	0
W	0	0.00	0	0	0	0
ROOF	0	0.00	0	0	0	0
PARTITION	0	0.00	0	0	0	
SHADED WALLS	0	0.00	0	0	0	

HEAT GAIN SUMMARY PEAK BLDG. LOAD OCCURS AT: 1300 HRS

EXTERNAL HEAT GAINS: (BTUH)		INTERNAL HEAT GAINS: (BTUH)			
WALLS	0	HUMAN	640,000		
ROOF	0	LIGHTS	2,019,131		
WINDOWS - SOLAR	0	EQUIPT	1,346,087		
WINDOWS - COND	0	OTHER	0		
OUTSIDE AIR	1,523,085				TOTAL BLDG. LOAD
SUBTOTALS	1,523,085		4,005,218	=	5,528,303 BTUH
					460.7 TONS

COOLING SYSTEM:

OPERATING HOURS	8752 HR/YR	EXISTING CENTRAL SYSTEM CAP.	1500.0 TONS
POWER USE-COMPRESSOR	0.79 KW/TON	WINDOW A/C UNITS	0 TONS
POWER USE-AUXILIARIES	0.2 KW/TON	WINDOW A/C AREA	0 SF
POWER USE-AIR HANDLERS	0.40 W/CFM	F.L. OCCUPANCY	3,562 HR/YR
SUPPLY AIR VOLUME	390000 CFM	F.L. LIGHTING	7,717 HR/YR
EXTERNAL F.L. HOURS	1311 HOURS		

ANNUAL ENERGY USED FOR COOLING:

REFRIGERATION	1,991,184 KWH/YR		
AUXILIARIES	806,395 KWH/YR		
AIR DISTRIBUTION	1,365,312 KWH/YR		
TOTAL	4,162,891 KWH/YR	=	14,207.95 MBTU/YR

5.3 LIGHTING ENERGY

The connected lighting wattage is estimated on a per square foot basis of the facility. From the known operational pattern of the facility, a typical 24-hour variation in lighting load is generated. Using a similar procedure to the Bin Method, the connected lighting load is converted to actual loads for each hour by weighting factors which represent the fractional lighting loads occurring for that hour. By summing the fractional loads over the 24-hour period, the equivalent full-load lighting hours for one day are thus calculated, and the annual full-load hours follow from the number of operational days in the year.

The annual energy consumed for lighting is:

Lighting Load:

Air Conditioned Area: 197,200 S.F. x 3 w/SF = 591.6 KW

Non-Air Conditioned Area: 35,300 S.F. x 2 w/SF = 70.6 KW

Total Lighting Load = 662.2 KW

Annual Full Load Hours = 7,717 hrs/yr

Annual Lighting Energy = 662.2 KW x 7,717 Hrs

= 5,110,197 KWH/yr

= 17,441.10 MBTU/yr

5.4 DOMESTIC HOT WATER ENERGY

Domestic hot water energy is calculated based on the following assumptions:

Average Number of Occupants = 250
Daily H.W. Consumption = 20 gpd/person
Annual H.W. Consumption = 250 x 20 gpd x 365 days = 1,825,000 gal/yr

The annual hot water energy consumption is:

1,825,000 gal x 8.33 x (120 - 70) = 760.11 MBTU/yr

Actual energy requirement using heat pumps (COP = 3)

$$\frac{760.11}{3} = 253.37 \text{ MBTU/yr}$$
$$= 74,237 \text{ KWH/yr}$$

5.5 OTHER ELECTRIC EQUIPMENT

This end-use category includes miscellaneous electric equipment including computers, office machines and other appliances. This category is estimated on a per square foot basis of the facility.

Floor Area	=	197,200 SF
Load Factor	=	2 W/SF
Diversity Factor	=	60%
Total Estimated Load	=	2 W/SF x 197,200 SF x 0.6
	=	236.6 KW
Annual Full Load Hour	=	8,760 hrs/yr

Annual other equipment energy is:

236.6 KW x 8,760 hrs = 2,072,616 KWH/yr
= 7,073.64 MBTU/yr

5.6 SUMMARY

The estimated present energy consumption of the Kunia Field Station is summarized as follows:

Category	KWH/yr	MBTU/yr	$/yr	%	MBTU/SF
A/C	4,162,891	14,207.95	262,279	36.5	0.061
Lighting	5,110,197	17,441.10	321,962	44.7	0.075
D.H.W.	74,237	253.37	4,677	0.7	0.001
Others	2,072,616	7,073.84	130,583	18.1	0.030
TOTALS	11,419,941	38,976.26	719,501	100.0	0.167

Both the present energy consumption (baseline) and energy savings attributed to ECO's are calculated individually for each recommended ECO. The present energy consumption minus the energy savings will equal the projected energy consumption after implementation of the recommended projects.

Table 5-2 is a summary of the various energy end uses. The "entire facility" is defined as the Kunia Field Station and these totals provide a station-wide look at the energy being consumed. The summation of only the systems evaluated as recommended ECO's is designated "Recommended ECO's only" and is provided to give a specific look at the energy consumption of the systems being evaluated as ECO's.

Figure 5-1 through 5-7 illustrate the results of Table 5-2 in graphic form. These figures facilitate at a glance the magnitude and percentages of all the energy end uses relative to each other.

TABLE 5-2

BUILDING ENERGY END-USE ANALYSIS

CATEGORY	KWH/YR	MBTU/YR	$/YR	%	MBTU/SF	REDUCTION
PRESENT ENERGY CONSUMPTION OF ENTIRE FACILITY						
A/C	4,162,891	14,207.95	$262,279	36.5	0.061	
LIGHTING	5,110,197	17,441.10	$321,962	44.7	0.075	
D.H.W.	74,237	253.37	$4,677	0.7	0.001	
OTHERS	2,072,616	7,073.84	$130,583	18.1	0.030	
TOTAL	11,419,941	38,976.26	$719,501	100.0	0.167	
PRESENT ENERGY CONSUMPTION OF SYSTEMS INVOLVED IN ECO'S						
A/C	477,388	1,629.33	$30,077	60.7		
LIGHTING	269,440	919.60	$16,976	34.2		
D.H.W.	40,088	136.82	$2,526	5.1		
OTHERS	0	0.00	0	0		
TOTAL	786,916	2,685.74	$49,579	100.0		
ENERGY SAVINGS OF RECOMMENDED ECO'S						
A/C	160,586	548.08	$10,118	58.9		
LIGHTING	96,227	328.42	$6,063	35.3		
D.H.W.	15,867	54.15	$1,000	5.8		
OTHERS	0	0.00	$0	0.0		
TOTAL	272,680	930.66	$17,180	100.0		
PROJECTED ENERGY CONSUMPTION OF SYSTEMS INVOLVED IN ECO'S						
A/C	316,802	1,081.25	$19,960	61.6		33.6%
LIGHTING	173,213	591.18	$10,913	33.7		35.7%
D.H.W.	24,221	82.67	$1,526	4.7		39.6%
OTHERS	0	0.00	$0	0.0		0.0%
TOTAL	514,236	1,755.09	$32,399	100.0		34.7%
PROJECTED ENERGY CONSUMPTION OF ENTIRE FACILITY						
A/C	4,002,305	13,659.87	$252,161	35.9	0.059	3.9%
LIGHTING	5,013,970	17,112.68	$315,900	45.0	0.074	1.9%
D.H.W.	58,370	199.22	$3,678	0.5	0.001	21.4%
OTHERS	2,072,616	7,073.84	$130,583	18.6	0.030	0.0%
TOTAL	11,147,261	38,045.60	$702,322	100.0	0.164	2.4%

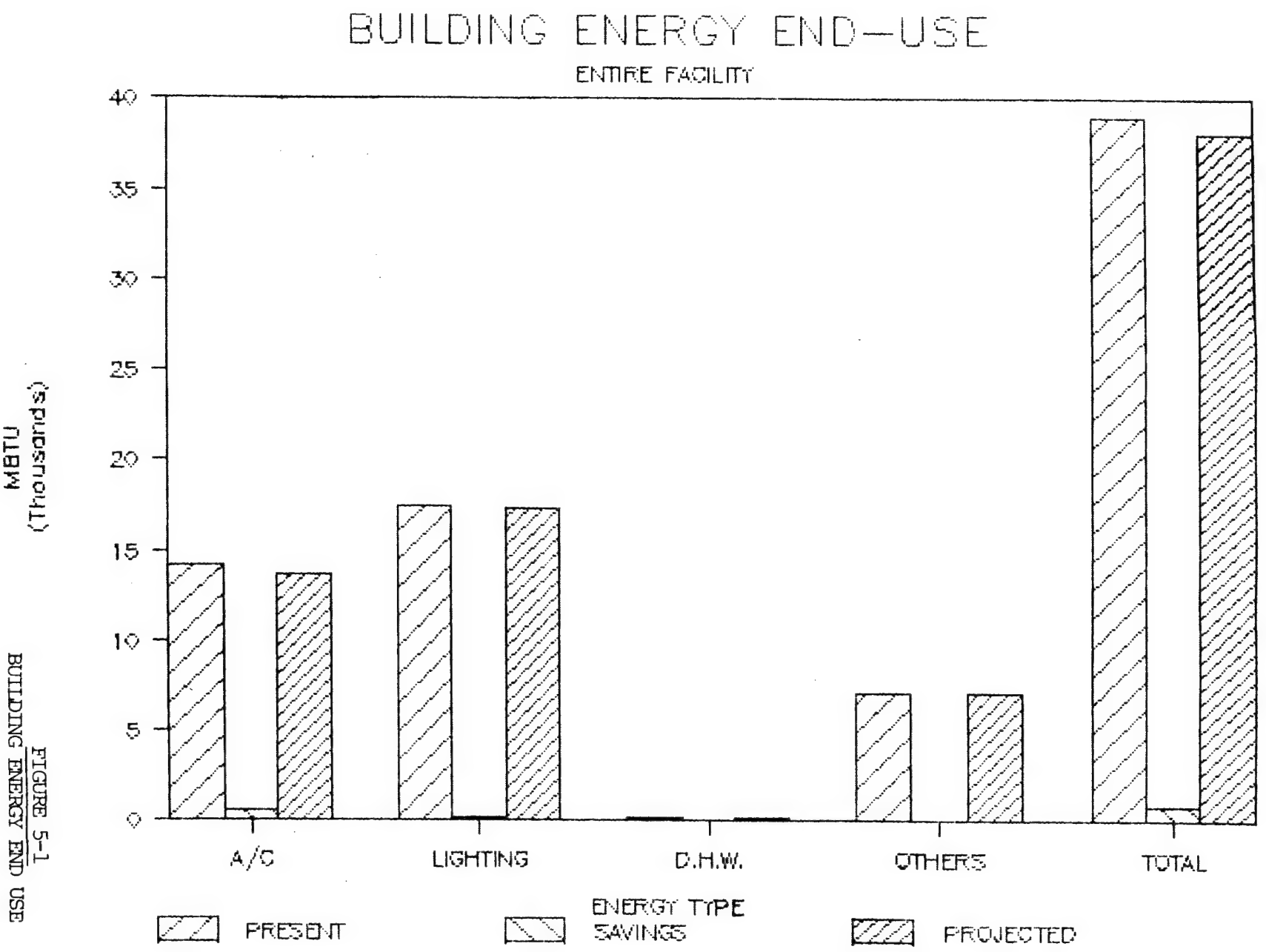


FIGURE 5-1
BUILDING ENERGY END USE

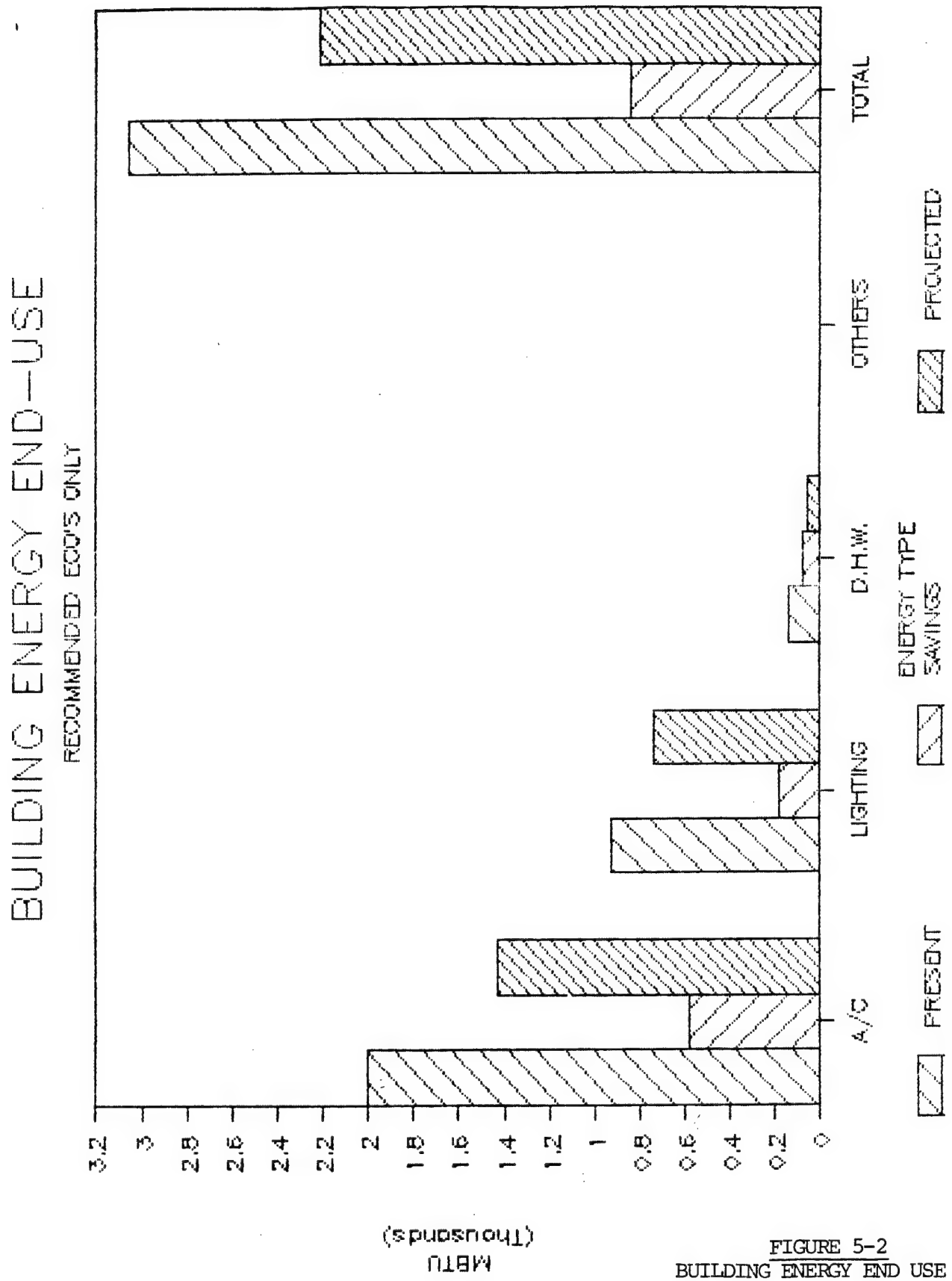


FIGURE 5-2
BUILDING ENERGY END USE

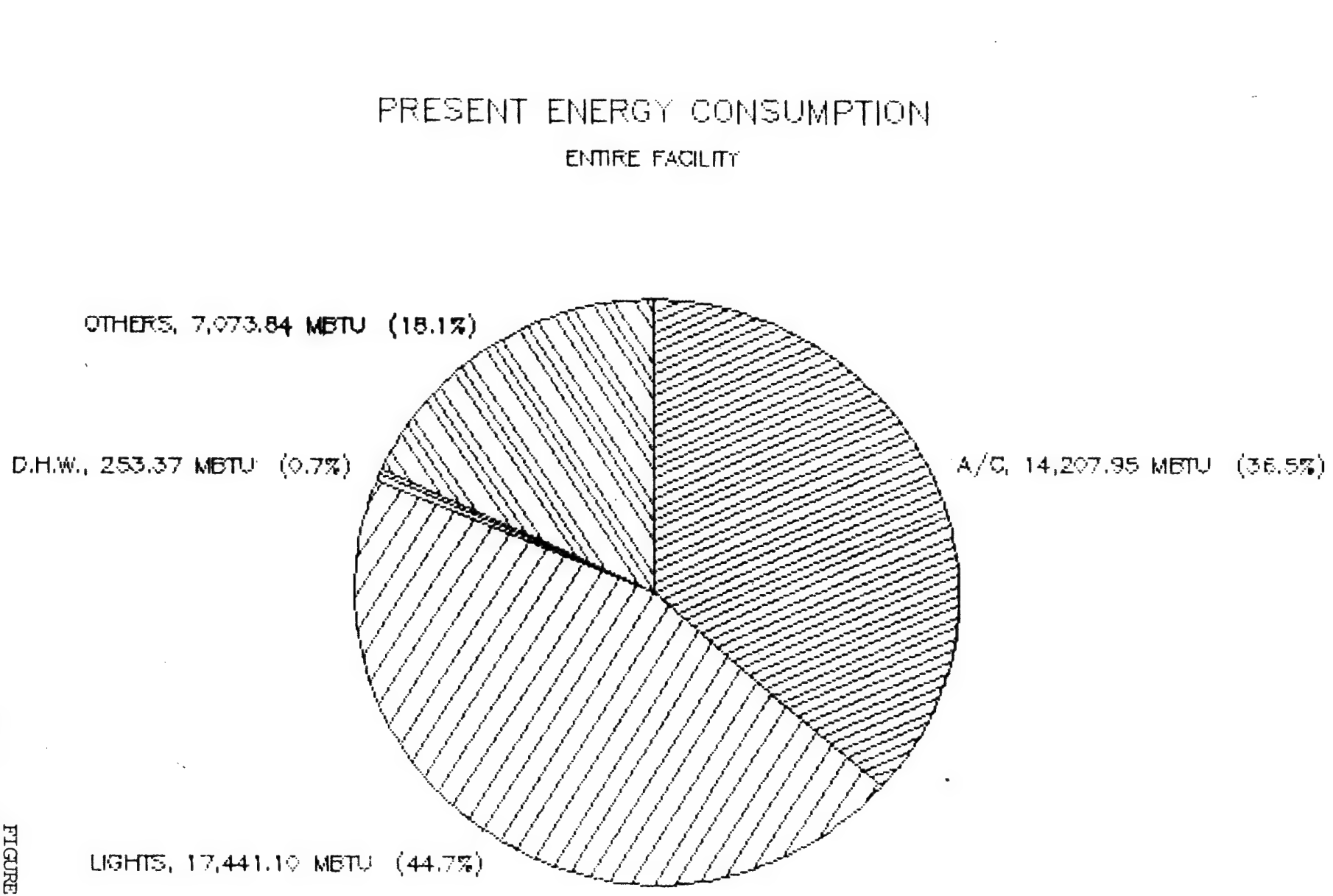


FIGURE 5-3
PRESENT ENERGY CONSUMPTION

PRESENT ENERGY CONSUMPTION

RECOMMENDED ECO'S ONLY

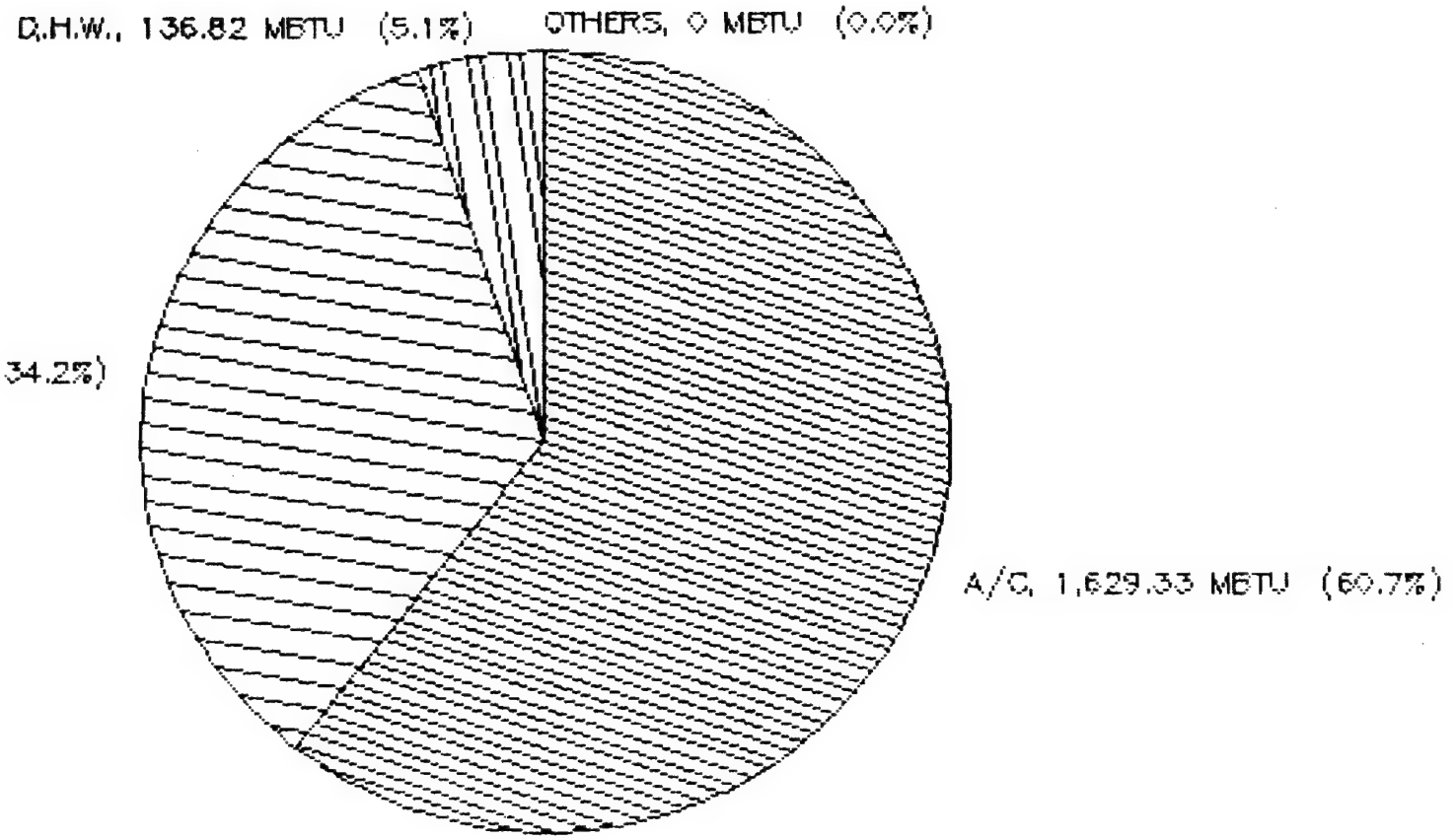


FIGURE 5-4
PRESENT ENERGY CONSUMPTION

ENERGY SAVINGS OF ECO'S

RECOMMENDED ECO'S ONLY

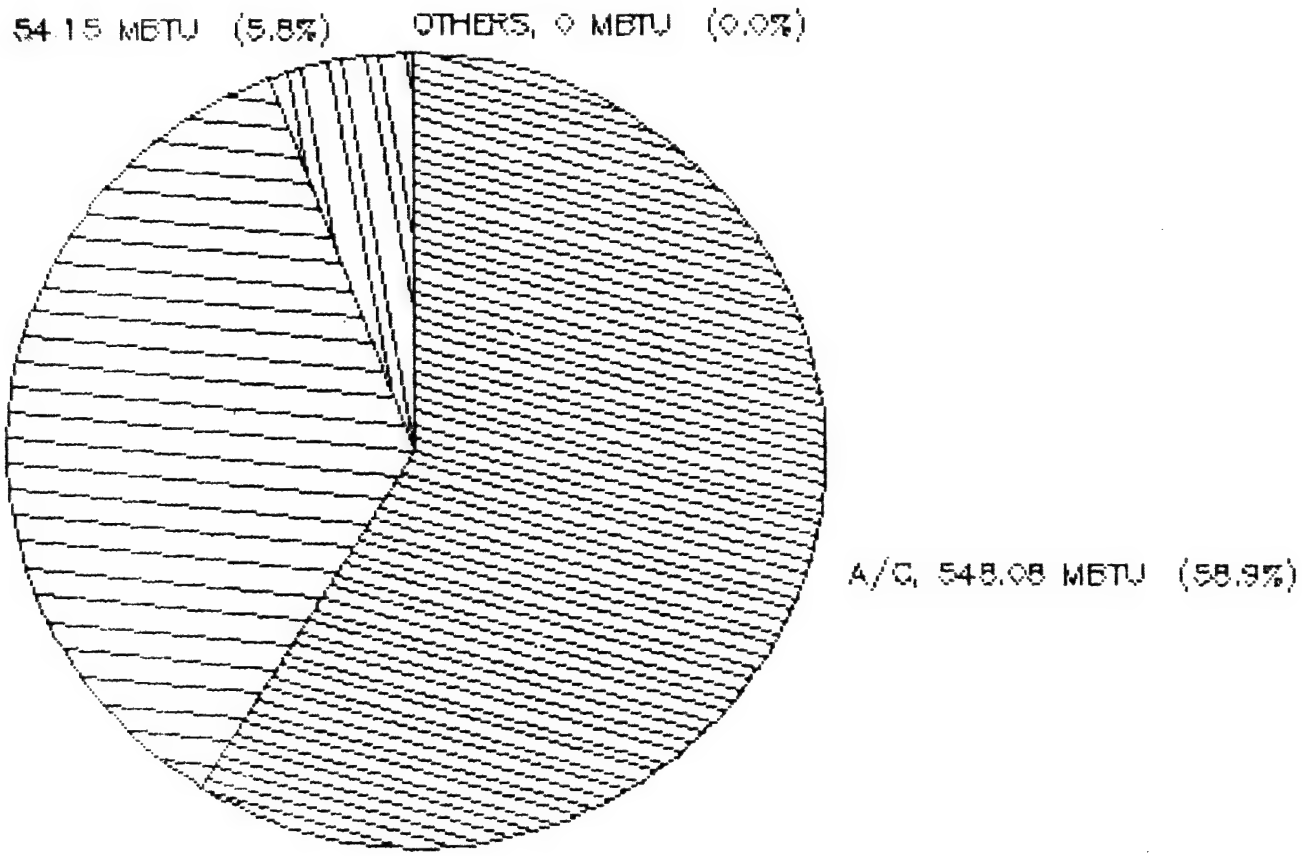


FIGURE 5-5
ENERGY SAVINGS BY ECO's

PROJECTED ENERGY SAVINGS

RECOMMENDED ECO'S ONLY

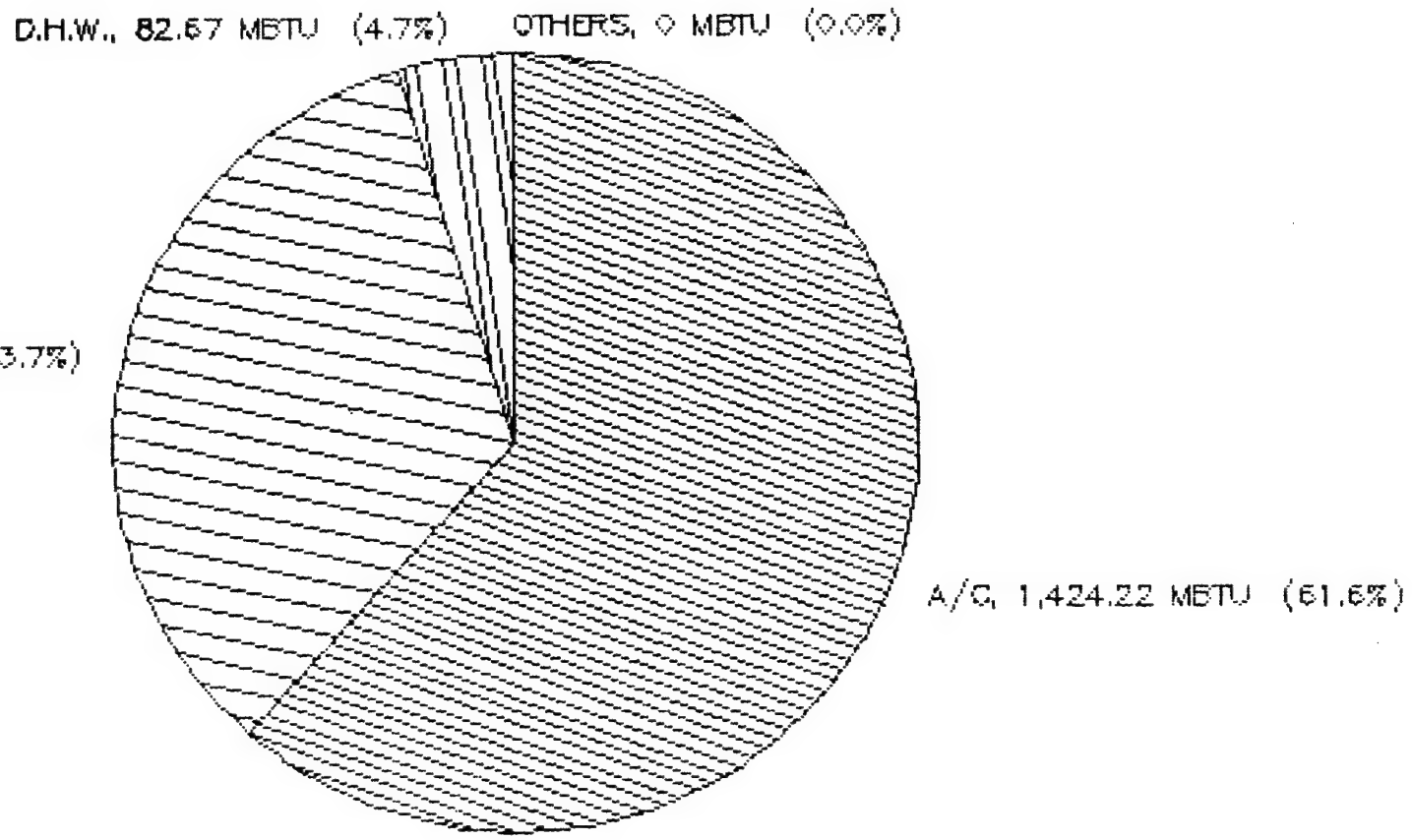


FIGURE 5-6
PROJECTED ENERGY CONSUMPTION

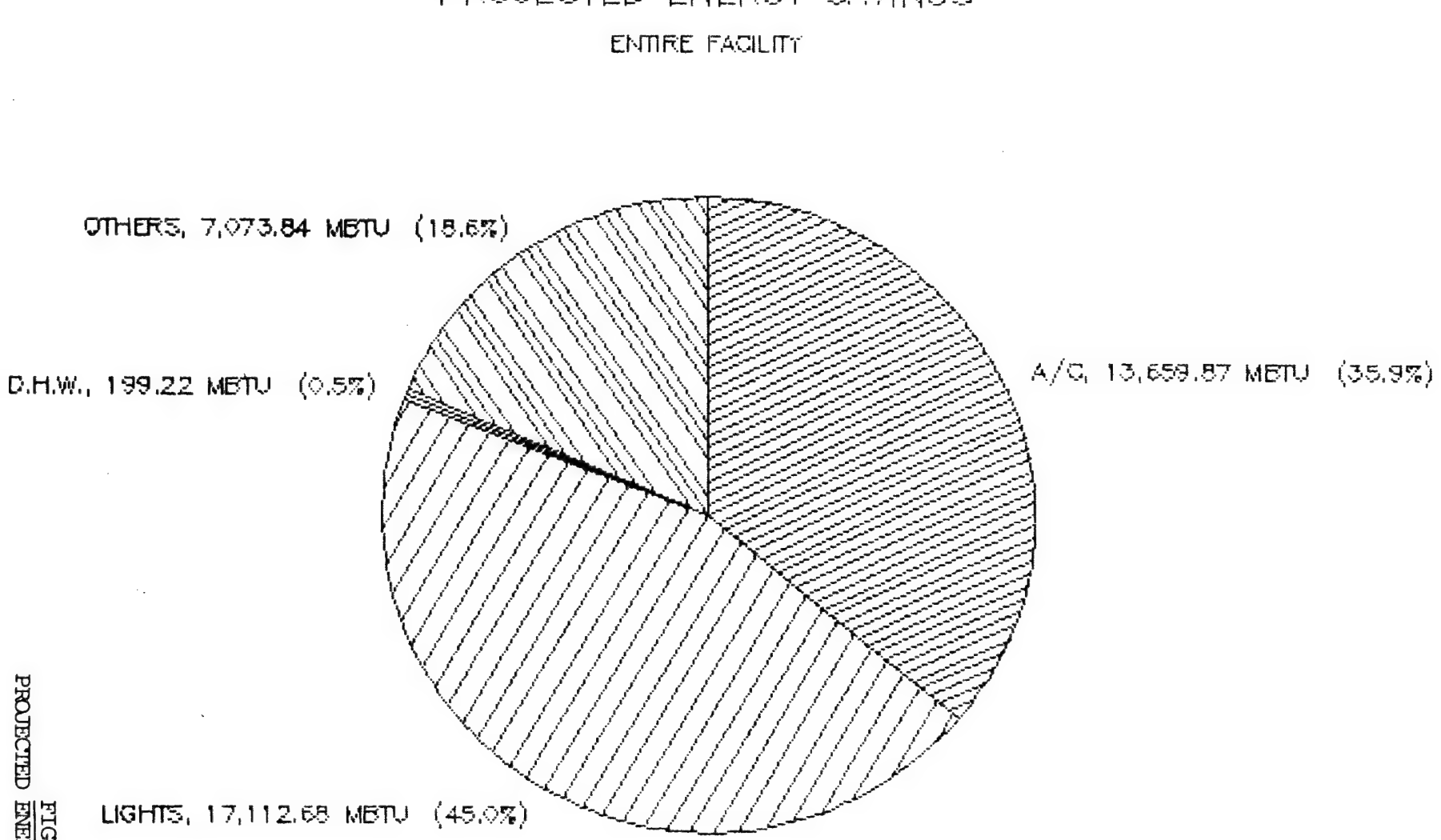


FIGURE 5-7
PROJECTED ENERGY CONSUMPTION

CHAPTER 6
PROJECT SUMMARY AND RECOMMENDATIONS

6.1 PROJECT SUMMARY

The evaluated ECO's are listed on Table 6-1 by their SIR rank. Table 6-1 also shows the estimated construction costs, annual energy savings in MBTU and dollars, SIR and Simple Payback Period (SPB) for individual projects.

6.2 RECOMMENDATIONS

As shown on Table 6-1, eight (8) ECO's are recommended for funding and they represent a total construction cost of $89,782, annual energy savings of 845.15 MBTU, and a total annual savings of $15,604. Their average SIR is 3.54 and SPB is 4.6 years. For these projects, the implementation documents are prepared and included in Appendix B.

Two (2) ECO's are not recommended. ECO E-1 (Install Dimmers for Computer Area Lighting) failed to qualify due to its SIR being lower than 1.0. Although the SIR of ECO M-1 (Timeclock Control of A/C System in Dining Area) is 7.94, much higher than 1.0, it is not recommended because the timeclock control of the air handling unit serving the Dining Area would jeopardize the operation of adjacent areas which are served by the same air handling unit.

As illustrated by the results of this survey, most of the energy savings are attributed to the improvement of air conditioning and ventilating systems and secondly, to the replacement of lighting fixtures with more efficient fixtures.

This survey also identified numerous Maintenance Items which are listed in paragraph 1.5.3 and explained in CHAPTER 3. One item of note is to block-off forty (40) exhaust outlets in the entrance tunnel into the facility. This item is not related to the energy conservation, but recommended as a Maintenance Item to improve the hazardous conditions at the turnaround point of the tunnel.

TABLE 6-1

LIST OF ECO'S RANKED BY SIR

ECO No.	DESCRIPTION	INVESTMENT COST ($)	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS $/YR	SIR	SPB
RECOMMENDED PROJECTS						
E-2	REPL. INCAN TO FLOUR.	$7,046	88.70	$3,971	6.28	1.8
E-3	REPL. INCAN TO FLOUR.	$3,031	52.32	$1,661	5.99	1.8
E-4	REPL. INCAN TO FLOUR.	$972	8.20	$468	5.42	2.1
M-4	TIMECLOCK, KITCHEN EXH.	$17,360	240.27	$4,435	2.05	3.9
E-5	REPL. INCAN TO HPS	$25,450	32.05	$3,669	1.65	6.9
M-5	IMPR. TUNNEL VENTILATION	$22,050	164.44	$3,036	1.11	7.3
M-3	CONSOLIDATE DHW	$15,847	82.67	$1,526	1.00	10.4
	TOTALS	$91,756	668.65	$18,766	3.36	4.9
NOT RECOMMENDED PROJECTS						
M-1 *	TIMECLOCK, A/C	$1,922	90.82	$1,677	7.00	1.1
M-2	CONVERT A/C TO CH WATER	$8,666	52.56	$970	0.90	8.9
E-1	INSTALL DIMMERS	$84,809	147.15	$2,716	0.33	31.2
	TOTALS	$93,475	199.71	$3,686	0.62	20.1

* ALTHOUGH SIR OF ECO M-1 IS GREATER THAN 1.0, IT IS NOT RECOMMENDED BECAUSE THE AIR HANDLING UNIT FOR THE DINING AREA SERVES OTHER AREAS TOO.

CHAPTER 7
IMPLEMENTATION DOCUMENTS

7.1 GENERAL REQUIREMENTS

In accordance with the directive by the DFE as described in the confirmation letter enclosed in Appendix A, the implementation documents have been prepared as follows:

A. Prepare implementation documents for each recommended ECO's.

B. Implementation documents consist of DA Form 4238 and necessary backup data including energy savings analysis, cost estimate and life cycle cost analysis.

C. Since all required backup data are included in Appendix B, enclose DA Form 4238 at the front of each respective ECO analysis in Appendix B.

D. No separate submittal is required for the implementation documents.

APPENDICES

APPENDIX A

SCOPE OF WORK AND CORRESPONDENCE

Attached to and made a part of Contract No. DACA83-86-D-0101, Delivery Order No. 0005.

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

GENERAL SCOPE OF WORK FOR AN ENERGY SAVINGS OPPORTUNITY SURVEY

U.S. ARMY FIELD STATION KUNIA, OAHU, HAWAII

May 26, 1987

SCOPE OF WORK
FOR AN
ENERGY SAVINGS OPPORTUNITY SURVEY
ENERGY ENGINEERING ANALYSIS PROGRAM
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7.3 Perform a Limited Site Survey

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ANNEX

A - GENERAL ENERGY CONSERVATION OPPORTUNITIES

B - DETAILED SCOPE OF WORK

C - REQUIRED DD FORM 1391 DATA

D - EXECUTIVE SUMMARY GUIDELINE

1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (AE) shall:

1.1 Review for general information any energy studies and current and future related construction projects which were or will be performed at this installation.

1.2 Evaluate selected ECOs to determine their energy savings potential and economic feasibility.

1.3 Perform a limited site survey of selected areas to insure that any new methods of energy conservation which are practical and have not been evaluated in any previous energy study have been considered and the results documented.

1.4 Provide complete new programming or implementation documentation for all recommended ECOs.

1.5 Prepare a comprehensive report to document the work performed, the results and the recommendations.

2. GENERAL

2.1 The information and analysis outlined herein are considered to be minimum essentials for adequate performance of this study.

2.2 The AE shall ensure that all methods of energy conservation which will reduce the energy consumption of the installation in compliance with the Army Facilities Energy Plan including those listed in Annexes A and B have been considered and documented. All methods of energy conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures as well as physical facilities. All energy conservation opportunities which produce energy or dollar savings shall be documented in this report. Any energy conservation opportunity considered infeasible shall also be documented in the report with reasons for elimination. A list of general energy conservation opportuniies (ECOs) to be used when evaluating specific areas is included as Annex A to this scope. Annex B contains a list of ECOs specifically for this installation. Both of these lists shall be considered and the evaluation of each ECO documented in the report. These lists are not intended to be restrictive but only to assure that basic and generally repetitive opportunities are addressed in the report. Some of the energy conservation opportunities in Annex A may not be applicable to the specific area at this installation. A statement to that effect is all that is required.

2.3 The study shall include the energy consuming areas listed in Annex B.

2.4 The study shall consider the use of all energy sources. The energy sources include electrical, natural gas, liquified petroleum gas, bulk oil, other oil products, steam when procured, gasoline, coal, solar, etc.

2.5 The "Energy Conservation Investment Program (ECIP) Guidance", described in letter from DAEN-MPO-U, 10 August 1982 and revised by letters from DAEN-ZCF-U, 4 March 1985 and 11 June 1986, establishes criteria for ECIP projects and shall be used for performing the economic analyses of all ECOs and projects. Construction cost escalation for DD Form 1391 submission shall be calculated using the guidelines contained in AR 415-17 and the latest Tri-Service MCP Index. The Tri-Service MCP Index, when updated, is contained in the latest applicable edition of the Engineer Improvement Recommendation System (EIRS) bulletin.

2.6 Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar ECOs into larger packages which will qualify for ECIP or MCA funding, and determining, in coordination with installation personnel, the appropriate packaging and implementation approach for all feasible ECOs.

2.7 Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Savings Investment Ratio (SIR).

2.8 All feasible non-ECIP projects shall be ranked in order of highest to lowest SIR.

3. PROJECT MANAGEMENT

3.1 Project Managers. The AE shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The AE's designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for coordination of work required under this contract. The Contracting Officer will designate a project manager to serve as the Government point of contact and liaison for all work required under this contract. This individual will be the Government's representative.

3.2 Installation Assistance. The Directorate of Facilities Engineering (DFE), U.S. Army Support Command, Hawaii will designate an individual who will serve as the point of contact for obtaining information and assisting in establishing contacts with the proper individuals and organizations as necessary to accomplish the work required under this contract.

3.3 Public Disclosures. The AE shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4 Meetings. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The AE and/or the designated representative(s) shall be required to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer.

3.5 Site Visits, Inspections, and Investigations. The AE shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work. AE will be accompanied by a DFE representative during the site investigation. The AE shall provide two (2) weeks notice to the DFE point of contact prior to site visitation.

3.6 Records

3.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The AE shall forward to the Contracting Officer within ten (10) calendar days, a reproducible copy of the records.

3.6.2 The AE shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall forward to the Contracting Officer within ten (10) calendar days, a reproducible copy of the record or receipt.

3.7 Interviews. The AE and Government's representative shall conduct entry and exit interviews with the Directorate of Facilities Engineering (DFE) before starting work at the installation and after completion of the field work. The Government's representative shall schedule the interviews at least one (1) week in advance.

3.7.1 Entry. The entry interview shall thoroughly brief and describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

a. Schedules.

b. Names of energy analysts who will be conducting the site survey.

c. Proposed working hours.

d. Support requirements from the DFE.

3.7.2 Exit. The exit interview shall include a thorough briefing describing the items surveyed and probable areas of energy conservation. The interview shall also solicit input and advice from the DFE.

4. SERVICES AND MATERIALS. All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, superintendence and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5. PROJECT DOCUMENTATION. All energy conservation opportunities (ECOs) which the AE has considered shall be included in one of the following categories and presented in the report as such:

5.1 ECIP Projects. To qualify as an ECIP project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than $200,000, a Savings Investment Ratio (SIR) greater than one and a simple payback period of less than ten years. The AE shall check with the installation for guidance. The overall project and each discrete part of the project shall have a SIR greater than one. For all projects meeting the above criteria, complete programming documentation will be required. Programming documentation shall consist of a DD Form 1391, Life Cycle Cost Analysis Summary Sheet(s) (with necessary backup data to verify the numbers presented), and a project development brochure (PDB). A Life Cycle Cost Analysis Summary Sheet shall be developed for each ECO and for the overall project when more than one ECO is combined.

5.2 Non-ECIP Projects. Projects which normally do not meet ECIP criteria, but which have an overall SIR greater than one shall be documented. The Life Cycle Cost Analysis Summary Sheet shall be completed through and including line 6 for all projects or ECOs. Each shall be analyzed to determine if they are feasible even if they do not meet ECIP criteria. These ECOs or projects may not meet the nonenergy qualification test. For projects or ECOs which meet this criteria, the Life Cycle Cost Analysis Summary Sheet, completely filled out, with all the necessary backup data to verify the numbers presented, a complete description of the project and the simple payback period shall be included in the report. Additionally, these projects shall have the necessary documentation prepared, in accordance with the requirements of the Government's representative, for one of the following categories:

a. Quick Return on Investment Program (QRIP). This program is for projects which have a total cost not over $100,000 and a simple payback period of two years or less.

b. OSD Productivity Investment Funding (OSDPIF). This program is for projects which have a total cost greater than $100,000 and a simple payback period of four years or less.

c. Productivity Enhancing Capital Investment Program (PECIP). This program is for projects which have a total cost of more than $3,000 and a simple payback period of four years or less.

The above programs are all described in detail in AR 5-4, Change No. 1.

d. Regular-Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than $200,000 and a simple payback period of ten to twenty-five years. Projects or ECOs which qualify for this program shall be economically analyzed in accordance with the requirements for Special Directed Studies in Engineering Technical Letter (ETL) 1110-3-332.

e. Low Cost/No Cost Projects. These are projects which the DFE can perform using his funds.

5.3 Nonfeasible ECOs. All ECOs which the AE has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6. DETAILED SCOPE OF WORK. The general Scope of Work is intended to apply to contract efforts for the Army installations under this contract except as modified by the detailed Scope of Work for the installation. The detailed Scope of Work is contained in Annex B.

7. WORK TO BE ACCOMPLISHED.

7.1 Review Previous Studies and Current and Future Related Construction Projects. The AE shall review for general information any energy studies and current and future related construction projects performed at the installation. This review should acquaint the AE with the work that has been and will be performed. The survey data contained in the previous study and construction project should be very helpful to the results of this study.

7.2 Evaluate Selected ECOs. The AE shall analyze the ECOs listed in Annex B. These ECOs shall be analyzed in detail to determine their feasibility. Savings Investment Ratios (SIRs) shall be determined using current ECIP guidance. The necessary data required for these projects may not be available, requiring the AE to visit the installation to obtain any necessary information. The AE shall provide all data needed to support the recommended ECO. All assumptions shall be clearly stated. Calculations shall be prepared showing how all numbers in the ECO were figured. Calculations shall be an orderly step-by-step progression from the first assumption to the final number. A Life Cycle Cost Analysis Summary Sheet shall be prepared for each ECO and included as part of the supporting data.

7.3 Perform a Limited Site Survey. The AE shall conduct a limited site survey to evaluate the areas listed in Annex B. The list of ECOs in Annex A shall be used when evaluating these areas. This list is not intended to be will produce energy, manpower or dollar savings. These should be evaluated the same as the other ECOs. Each of the items shall be considered and discussed in the report. Those items on the list which are not practical, have been previously accomplished, are inappropriate or can be eliminated from detailed analysis based on preliminary analysis shall be listed in the report along with the reason for elimination from further analysis. All potential ECOs which are not eliminated by preliminary considerations shall

restrictive but only to assure that these opportunities, as a minimum, are considered. The AE may be aware of other ECOs not included in Annex A thatbe thoroughly documented and evaluated as to technical and economic feasibility. The AE shall obtain all the necessary data to evaluate the ECOs by conducting a site survey. However, the AE is encouraged to use any data that may have been documented in a previous study. The AE shall document his site survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report. All tests and/or measurement equipment shall be properly calibrated prior to its use. For ECOs which would replace the existing heating, ventilating, and air conditioning (HVAC) system or significantly change it (such as converting a multizone system to a variable air volume (VAV system)) the AE is required to run a computer simulation to analyze the system and to determine the energy savings. This requirement to use computer modeling applies only to heated and air conditioned or air conditioned only buildings which exceed 8,000 square feet or heated only buildings in excess of 20,000 square feet. The computer program shall analyze the building on an hour-by-hour basis rather than the bin data method or bin data to simulate an hour-by-hour analysis. Unless the Building Loads Analysis and System Thermodynamic (BLAST) program is used, the AE shall submit a sample computer run with an explanation of all input and output data and a summary of program methodology and energy evaluation capabilities for approval by the Contracting Officer prior to use of the program for analysis. The computer program used must be comparable to the BLAST program.

7.4 Provide Programming or Implementation Documentation. For projects or ECOs reevaluated or developed during this study, complete programming or implementation documentation shall be prepared by the AE.

7.4.1 Programming Documentation. For projects or ECOs which meet ECIP criteria and which the installation wants to submit as an ECIP project, complete programming documentation shall be prepared. Complete programming documentation consists of DD Form 1391, Project Development Brochure (PDB) and supporting data. These forms shall be separated from the narrative report. They shall be bound similarly to the final report in a manner which will facilitate repeated disassembly and reassembly. Prior to preparation of the programming documents a sample programming document shall be submitted for review and approval. This sample shall be submitted no later than with the interim submittal. This sample shall be approved before any other programming documents are prepared. To the degree possible, the project or ECO selected for the sample submission shall be typical of the majority of subsequent projects to be submitted. The sample shall consist of complete programming documents with primary emphasis on format and manner of presentation rather than precise accuracy of cost estimates and energy savings data.

7.4.1.1 Military Construction Project Data (DD Form 1391). These documents shall be prepared in accordance with AR 415-15 and the supplemental requirements in Annex C. A complete DD Form 1391 shall be prepared for each project. The form shall include a statement that the project results from an EEAP study. Documents shall be complete as required for submission to higher DA headquarters. These programming documents will require review and

signatures by the proper installation personnel. All documents shall be completed except for the required signatures.

7.4.1.2 Project Development Brochure (PDB). Preparation of the PDB requires the AE to delineate the functional requirements of the project as related to the specific site. The AE shall prepare PDBs in accordance with AR 415-20 and TM 5-800-3. Most projects will not require all the forms and checklists included in the Technical Manual (TM). Only that information needed for the project shall be included. The PDB-I format described in the TM shall be used for whatever information is needed.

7.4.1.3 Supporting Data. The AE shall provide all data and calculations needed to support the recommended project. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be included. A Life Cycle Cost Analysis Summary Sheet shall be prepared for each ECIP project and each discrete part of the project and included as part of the supporting data.

7.4.2 Implementation Documentation. For feasible projects or ECOs which normally do not meet ECIP criteria, implementation documentation shall be prepared. Each feasible project or ECO shall be individually packaged and fully documented and included as a separate section in the volume containing the programming documentation. Each project or ECO shall have a complete description of the changes required, economic justifications, sketches, and other backup data included as a section in the report. The documentation required will be as determined by the Government's representative. Documentation required will be in the categories listed in paragraph 5.2. For the QRIP, OSD PIF and PECIP projects, documentation shall be prepared in accordance with the requirements of AR 5-4, Change No. 1. For MCA projects the documentation required shall be in accordance with paragraph 7.4.1 except that the economic analysis required by ETL 1110-3-332 shall be included in lieu of the ECIP Life Cycle Cost Analysis. For low cost/no cost projects which the DFE personnel can perform, the following information shall be provided:

a. Brief description of the project.

b. Brief description of the reasons for the modification.

c. Specific instructions for performing the modification.

d. Estimated dollar and energy savings per year.

e. Estimated manhours and labor and materials costs. Costs shall be calculated for the current calendar year and so marked. Manhours shall be listed by trade. For projects that would repair an existing system so that it will function properly, also include the estimated manhours by trade and labor and material costs necessary to maintain the system in that condition. Some of the simple practical modifications may be developed on a per unit basis. An example of this type of modification would be the repair or replacement of steam traps on an as needed basis. As a rule, however, the AE should develop complete projects, if at all possible, rather than per unit

modifications. Separate sheets for each project showing the above information shall be prepared and included in the report.

7.5 Submittals, Presentations and Reviews. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. The AE shall give a formal presentation of all but the final submittal to installation, command, and other government personnel. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. The AE shall provide all comments and written notification of the action taken on each comment to all reviewing agencies within three (3) weeks after the review meeting. It is anticipated that each presentation and review conference will require approximately one (1) working day. The presentation and review conferences will be at the installation on the date(s) agreeable to the DFE, the AE and the Government's representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

7.5.1 Interim Submittal. An interim report shall be submitted for review after completion of the field survey and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings and SIRs of all the ECOs shall be included. The simple payback period of all ECOs shall be calculated and shown in the report. The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. During the review period, the Government's representative shall coordinate with the DFE and provide the AE with direction for packaging or combining ECOs for programming purposes. A sample programming document (DD Form 1391, PDB, and supporting data) for one ECIP project shall be submitted with this submittal for review and approval. The survey forms completed during the audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.

7.5.2 Prefinal Submittal. The AE shall prepare and submit the prefinal report when all work under this contract is complete. The AE shall submit the Scope of Work for the installation studied and any modifications to the Scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The report shall include an

order of priority by SIR in which the recommended tasks should be accomplished. The synergistic effects of all the ECOs on one another shall have been determined and the results of the original calculations adjusted accordingly. Completed programming and implementation documents for all recommended new projects shall be included. The programming and implementation documents shall be ready for review and signature by the installation commander. The prefinal report, Executive Summary, and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The prefinal submittal shall be arranged to include (a) a separately bound Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables, and charts as much as possible (see Annex D for minimum requirements), (b) the narrative report containing a copy of the Executive Summary at the beginning of the volume and describing in detail what was accomplished and the results of this study, (c) appendices to include the detailed calculations and all backup material and (d) the programming and implementation documentation. A list of all projects and ECOs developed during this study shall be included in the Executive Summary and shall include the following data from the Life Cycle Cost Analysis Summary Sheet: the cost (construction cost plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost. The simple payback period should also be shown for these projects and ECOs.

7.5.3 Final Submittal. Any revisions or corrections resulting from comments made during the review of the prefinal report or during the presentation shall be incorporated into the final report. These revisions will be in complete new volumes. Pen and ink changes or errata sheets will not be acceptable. The new volumes submitted shall be in standard three-ring binders and shall contain all the information presented in the prefinal report with any necessary changes made.

ANNEX A

GENERAL ENERGY CONSERVATION OPPORTUNITIES

- Insulation (wall, roof, pipe, duct, etc.)
- Insulated glass or double glazed windows
- Weather stripping and caulking
- Insulated panels
- Solar films
- Vestibules
- Load dock seals
- Reduction of glass area
- Replace kitchen light fixtures
- Shutdown energy to hot water heaters or modify controls
- Energy conserving fluorescent lamps and ballast
- Reduce lighting levels
- Replace incandescent lighting
- Use more efficient lighting source
- Improve power factor
- High efficiency motor replacement
- Night setback/setup thermostats
- Infrared heaters
- Economizer cycles (dry bulb)
- Control hot water circulation pump
- FM radio controls
- Radiator controls
- Decentralize domestic hot water heaters

GENERAL ENERGY CONSERVATION OPPORTUNITIES
(Continued)

- Install shower flow restrictors or limited flow showerheads (2 to 3 GPM)
- Heat reclaim from hot refrigerant gas
- Reduce air flow
- Prevent air stratification
- Install time clocks
- Boiler oxygen trim control (fixed or portable)
- Revise boiler controls
- Chiller replacement
- Replace absorption chiller
- Chiller Controls
- Reduce street lights
- Insulate steam and condensate lines
- Return condensate
- Heat reclaim from family housing condenser units for preheating of domestic hot water
- Domestic hot water heat pumps
- Transformer overvoltage
- Transformer loading
- Revise or repair building HVAC controls
- Waste heat recovery
- Thermal storage
- Steam trap inspection
- Instantaneous hot water heater
- Air curtains
- Occupancy sensors to control lighting or HVAC

ANNEX B

DETAILED SCOPE OF WORK FOR DESIGNATED
FACILITIES AT U.S. ARMY FIELD STATION KUNIA
OAHU, HAWAII

1. U.S. Army Field Station Kunia, Oahu, Hawaii. U.S. Army Field Station Kunia facilities consist of a three (3) storied underground communication facility with minor support facilities located above grade. The underground facility has a square footage of approximately 248,500 square feet. The above grade existing structures consist of a transportation and storage building, a warehouse, two guard houses, an outdoor recreation area, and parking lots. A general ESOS will be performed for designated areas of U.S. Army Field Station Kunia. The designated areas, as well as the specific emphasis for evaluation are described as follows:

a. Survey of energy savings opportunities in the dining hall and snack bar areas of the underground facility.

b. Consolidation of the individualized water heaters to a central heating system for the underground facility.

c. Analyzing the possibility of using more efficient tunnel exhaust and lighting system for the underground facility.

d. Evaluate the possibility of installing dimmers or alternate switching for fluorescent lighting in computer area. Located on the first floor of the underground facility which comprises approximately 30,000 square feet.

e. Analyze the possibility of using more efficient lighting for the parking area, upper fenced area (antennas, cooling tower, etc.) and power plant.

f. Survey the cooling requirements and operations for the microwave facility in the upper exhaust tunnel and the power plant. Determining the most efficient use of the chiller systems.

g. Evaluate the underground ventilation system to ensure the most efficient outside air system which will maintain a positive pressure system in the entire underground facility.

2. Report submittals and reviews: Documents will be submitted in accordance with the following:

Submittal	Schedule-Calendar Days After NTP	Gov-t Review-Calendar Days	No. of Copies
a. Interim	90	45	15
b. Prefinal	180	45	15
c. Final	270	-	18

3. Distribution of report: The contractor will make distribution of the interim and prefinal reports with a forwarding letter requesting that adressees review and return comments within the above specified Government review period to:

Commander
U.S. Army Engineer Division, Pacific Ocean
ATTN: PODED-FM
Bldg 230
Fort Shafter, HI 96858-5440

a. Interim and Prefinal Reports:

(1) Six (6) copies to:
Commander
U.S. Army Support Command, Hawaii
ATTN: APZV-FEU
Fort Shafter, HI 96858-5000

(2) One (1) copy to:
Commander
U.S. Army Western Command
ATTN: APEN-IU
Fort Shafter, HI 96858-5100

(3) Three (3) copies to:
Commander
U.S. Army Engineer Division,
Pacific Ocean
ATTN: PODED-FM
Bldg 230,
Fort Shafter, HI 96858-5440

(4) Three (3) copies to:
Commander
U.S. Army Engineer Division, Huntsville
ATTN: HNDED-PM (Mr. B. Ganus)
P. O. Box 1600
Huntsville, AL 35807

(5) One (1) copy to:
Commander
U.S. Army Corps of Engineers
ATTN: DAEN-ECE-E (Mr. J. McCarty)
Washington, D. C. 20314-1000

(6) One (1) copy to: Commander
Headquarters, Department of the Army
ATTN: DALO-LEP (Mr. G. Keath)
New Cumberland AD
New Cumberland, PA 17070

b. Final Report. Distribution shall be in accordance with paragraph 5a above except six (6) copies will be provided to Commander, U.S. Army Engineer Division, Pacific Ocean, ATTN: PODED-FM, Bldg 230, Fort Shafter, HI 96858-5440.

4. PAYMENTS. Monthly payment shall be made on the AE's estimate of work accomplished upon submission on ENG Form 93, Payment Estimate - Contract Performance. This form shall include AE's certification that the payment estimate is correct and just, and the requested payment has not been received. In addition, with each certified payment request, the AE shall submit a concise progress report delineating work completed and problems encountered. The Contracting Office requires the AE billings be submitted to U.S. Army Engineer Division, Pacific Ocean, ATTN: PODED-MR by the 15th of each month. Upon approval, payment shall be made of ninety (90) percent of the amount as determined above. Upon satisfactory completion of all work under this contract, the AE will be paid the unpaid balance of any money due including ten (10) percent retained in previous payments.

5. USE OF INFORMATION. The information developed, gathered, assembled and reproduced by the Contractor or his Consultants, Sub-Contractors or their associates in fulfillment of the contract requirements as defined or related to the Scope of Work will become the complete property of the Government and will, therefore, not be used by the Contractor for any purpose at any time without the written consent of the Contracting Officer.

6. GOVERNMENT PROJECT MANAGER. The Government has designated a Project Manager (POD-PM) within POD who will serve as the main point of contact for the Contracting Officer: Wayne Hashiro, telephone 438-1489.

7. DFE POINT OF CONTACT. The DFE, USASCH coordinator to serve as the point of contact and liaison for all work is: Mr. George E. Newell, telephone 655-0791, Building 300, Wheeler Air Force Base, Hawaii. The DFE coordinator will be responsible for arranging clearance into the site for field investigation.

8. COORDINATION. During the prosecution of the work, close liaison shall be maintained with the POD-PM who will coordinate the work with other elements of DFE, HND, OCE, DALO-LEP, USASCH, WESTCOM. All correspondence and submittals will be coordinated through the POD-PM. All routine correspondence concerning field information, access, interface with utilities, etc., will be made directly with the organizations involved. However, the POD-PM will be kept informed of all coordination being made. All required coordination of a special nature will be made through the POD-PM only. Under no circumstances will any information concerning any matters directly related to the criteria, scope, scheduling or progress of projects

under this Scope of Work be divulged to any individual or organization without specific approval of the Contracting Officer or the POD-PM. All requests made by the Using Service and other agencies shall be referred to the POD-PM. Arrangements for visits to office of the Using Service, meetings, and coordination (other than routine) as required with other agencies will be made by the POD-PM upon request.

9. QUALITY REQUIREMENTS. The AE is responsible for the quality of all work accomplished under this contract. The review and checking of documents by DFE, USASCH, HND, OCE, DALO-LEP and WESTCOM does not relieve the AE of any responsibility. If errors are discovered at a later date, the AE shall be required to make necessary changes or perform other corrective action. Completed work will be transmitted by a letter signed by a principal of the firm certifying that all information has been coordinated and is complete and correct.

10. REFERENCES/GOVERNMENT FURNISHED INFORMATION. The following references apply to energy considerations and will be furnished by the Government at the specific request of the Contractor on a case by case basis for the period of the contract:

a. Army Facilities Energy Plan, 9 Dec 84.

b. Engineer Technical Letters (ETLs) 1110-3-254, Use of Electric Power for Comfort Space Heating; 1110-3-282, Energy Conservation; and 1110-3-332, Economic Studies.

c. U.S. Army Corps of Engineers, Architectural and Engineering Instructions Design Criteria, 13 March 1987.

d. Energy Conservation Investment Program (ECIP) Guidance, dated 10 Aug 82, revised 4 Mar 85 and 11 Jun 86.

e. Technical Manual - TM 5-785, Engineering Weather Data, TM 5-800-2, General Criteria Preparation of Cost Estimates, and TM 5-800-3, Project Development Brochure.

f. AR 415-15, Military Construction Army (MCA) Program Development, AR 415-17, Cost Estimating for Military Programming, AR 415-20, Construction, Project Development and Design Approval, AR 415-28, Department of the Army Facility Classes and Construction Categories, AR 415-35 Construction, Minor Construction, AR 420-10, General Provisions, Organization, Functions, and Personnel, and AR 5-4, Change No. 1, Department of the Army Productivity Improvement Program and AR 11-27, Army Energy Program.

g. Engineer Improvement Recommendation System (EIRS) Bulletin 84-01, dated 29 Jun 84 and Tri-Service Military Construction Program (MCP) Index for FY87 Program dated 4 Jan 85.

11. All ECIP projects will be based on FY91 (October 1990 - September 1991) for cost estimation, programming and implementation.

12. Thirty-five millimeter (35mm) color slides will be provided for ECIP projects reflecting existing conditions which can be used as supporting documentation for ECIP project approval.

13. A computer program titled Life Cycle Costing in Design (LCCID) is available from the Blast Support Office in Urbana, Illinois for a nominal fee. This computer program shall be used for performing the economic calculations for ECIP and non-ECIP ECOs. The Blast Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, Illinois 61801. The telephone number is (217) 333-3977.

ANNEX C

REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

a. In title block clearly identify projects as "ECIP."

b. Complete description of each item of work to be accomplished including quantity, square footage, etc.

c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).

d. List references, and assumptions, and provide calculations to support dollar and energy savings, and indicate any added costs.

(1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage floor area, window and wall area for each exposure.

(2) Identify weather data source.

(3) Identify infiltration assumptions before and after improvements.

(4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.

e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.

f. Lighting retrofit projects must identify number and type of fixtures, and wattage of each fixture being deleted and installed. New lighting shall be only of the level to meet current criteria. Lamp changes in existing fixtures is not considered an ECIP type project.

ANNEX D

EXECUTIVE SUMMARY GUIDELINE

1. Introduction.

2. Building Data (types, number of similar buildings, sizes, etc.)

3. Present Energy Consumption.

   - Total Annual Energy Used.

   - Source Energy Consumption.

     Electricity - KWH, Dollars, BTU
     Fuel Oil - GALS, Dollars, BTU
     Natural Gas - THERMS, Dollars, BTU
     Propane - GALS, Dollars, BTU
     Other - QTY, Dollars, BTU

   - Energy Consumption of the buildings in this study as compared to the basewide consumption.

4. Historical Energy Consumption.

5. Reevaluated Projects Results.

6. Energy Conservation Analysis.

   - ECOs Investigated.

   - ECOs Recommended.

   - ECOs Rejected. (Provide economics or reasons)

   - ECIP Projects Developed. (Provide list)*

   - Non-ECIP Projects Developed. (Provide list)*

   - Operational or Policy Change Recommendations.

* Include the following data from the Life Cycle Cost Analysis Summary Sheet: the cost (construction plus SIOH), he annual energy savings (type and amount), the annual dollar savings, the SIR and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost. Show the simple payback period for all ECOs.

M E M O R A N D U M

TO: FILES DATE: June 5, 1987

SUBJECT: Preproposal Meeting for EEAP/Kunia

TIME: 9:00 a.m., June 2, 1987

PLACE: POD

ATTENDEES: George Keys, DFE
Wayne Hashiro, POD
Rudy Mina, POD
Glenn Oyama, NOA
Y. J. Kim, RMTC

DISCUSSION:

A preproposal meeting was held as described above in order to clarify the scope of work for the EEAP/Kunia project. The following items were discussed and agreed upon during the meeting:

1. This survey will be limited to the designated areas specified in ANNEX B of the scope of work.

2. The Government will provide necessary information of areas where the A/E is not allowed to inspect.

3. Since the major renovation project is proceeding for the entire A/C system including the chiller plant, the ECO's for the main chiller plant will not be included in this surv

4. The tunnel (ANNEX B, item C) means the access tunnel which connects the tunnel entrance and the main facility.

5. Electrical field measurements will not be required in the survey.

Yong Jin Kim, P.E.
Project Manager

YJK:mh

R. M. TOWILL CORPORATION

677 ALA MOANA BLVD • SUITE 1016
HONOLULU, HAWAII 96813
(808) 524-8200

Engineering • Planning • Photogrammetry • Surveying • Construction Management • Energy Systems

October 8, 1987

Department of the Army
Pacific Ocean Division
Corps of Engineers
Building 230
Fort Shafter, Hawaii 96858-5440

Attention Mr. Wayne Hashiro:

Gentlemen:

SUBJECT: Energy Engineering Analysis Program (EEAP)
U. S. Army Field Station, Kunia, Hawaii

This is to confirm our telephone conversations with you and Mr. Roy Tamashiro of Military Branch with regard to the status of the subject project.

Upon receipt of the NTP, we gathered some as-built drawings and are about to proceed with the field investigations. However, we have been informed by your office that the following four (4) MCA projects are in the process of design:

1. FY86 MCA PN 173, A/C Upgrade
2. FY88 MCA PN 12, Power Upgrade
3. FY88 MCA PN 13, Life/Safety Upgrade
4. FY88 MCA PN 9215460, Ops. Gen. Purp.

After reviewing the scope of these projects, we have found that the first project, FY86 MCA PN 173, A/C Upgrade has potential impact on our project.

In accordance with Mr. Roy Tamashiro, the project (PN 173) is under the final design stage, but awaiting changes necessitated by the other projects. The final design of the project may not be available until January or February 1988.

Under the present circumstances, the subject project has to be deferred until such time the design of the A/C Upgrade project (PN 173) is definite and available to us. Should you have any questions related to this matter, please contact us at 524-8200.

Very truly yours,

Yong Jin Kim, P.E.
Project Manager

YJK:G-1

FILE COPY

MEMORANDUM

TO: Files DATE: January 11, 1988

SUBJECT: Energy Engineering Analysis Program
Kunia Field Station, Hawaii

DATE: January 11, 1988

PLACE: POD, Fort Shafter

ATTENDEES: George Keys; DFE
Wayne Hashiro; FE Support Branch, POD
Stanley Kon; Technical Engineering Branch, POD
Roy Tamashiro; Military Branch, POD
Glenn Oyama; Nakamura, Oyama & Associates
Y. J. Kim; R. M. Towill Corp.
Gordon Chong; R. M. Towill Corp.

DISCUSSION:

The project meeting was called by R. M. Towill Corp. (RMTC) to verify the scope of work and to incorporate current information on related projects. The following are the results of the discussion as listed per Annex B of the project scope of work dated May 26, 1987 and defined in the MFR dated June 5, 1987 (attached).

a. It was agreed that the entire kitchen dining and snack bar areas are to be included in the survey. RMTC requested "as-built" drawings and was informed that some may be available at PACDIV. RMTC will pursue the "as-built" drawings at PACDIV.

b. RMTC requested "as-built" drawings or related information on the entire hot water heating system. It was agreed that this matter would be coordinated with the maintenance personnel at Kunia Field Station.

c. The exhaust and lighting requirements of the access tunnel shall be surveyed for energy conservation.

d. Access to the computer rooms is not allowed to the A/E for field survey due to high security in that area. The government shall furnish the necessary information and assistance in the field such as measuring the light intensity of the rooms.

e. The lighting for the parking area, upper fenced area, and power plant shall be evaluated for possible energy conservation. Lighting in the power plant shall be checked for possible relocation of lighting fixtures due to screening by air conditioning ductwork.

f. The cooling requirements for the microwave facility will be included in the survey. It was reiterated that the chiller plant will not be part of the scope of work since renovation design work is being prepared for the overhaul and/or replacement of the existing chillers.

g. The underground ventilation system shall be surveyed for energy conservation including possible reduction of outside air, number of fans, fan sizes, etc.

OTHER RELATED AND PERTINENT ITEMS DISCUSSED:

a. The A/E requested a copy of the design analysis for the A/C renovation work. It was informed that the design work has not been completed by Mechanical Engineers of Hawaii (MEH). RMTC was instructed to contact MEH directly to obtain pertinent information for the energy study. Mr. Roy Tamashiro will notify MEH for coordination purposes.

b. The A/E requested a meeting with the Kunia Field Station personnel to assure further coordination and to obtain necessary information prior to the field survey. Mr. George Keys will arrange this meeting.

Based on the defined scope of work and relevent items as reviewed in this meeting, it was agreed that the work on this project shall proceed.

Yong-Jin Kim, P.E.
Project Manager

GC:G-1
Attach: Annex B
MFR dtd. 6/5/87

cc: G. Keys, DFE
W. Hashiro, FE Support Br., POD
G. Oyama, NO&A

MEMORANDUM

TO: Files DATE: January 14, 1988

SUBJECT: Energy Engineering Analysis Program
Kunia Field Station, Hawaii

DATE: January 14, 1988

PLACE: Field Station Kunia, Hawaii

ATTENDEES: Lt. Robert Prigge; IAHK-ENG
Alan Yamaoka; Nakamura, Oyama & Associates
Y. J. Kim; R. M. Towill Corp.
Gordon Chong; R. M. Towill Corp.

DISCUSSION:

This meeting was arranged by R. M. Towill Corp. (RMTC) to discuss the subject project with the engineering branch of Field Station Kunia (IAHK-ENG). The engineering branch was asked to provide information pertinent to the energy analysis and was also briefed on the intended procedures of the field survey. The following items were discussed:

1. There are approximately 200 occupants (average) in the building, 24 hours a day. During the day shift of 7:30-4:30, up to 1,000 occupants (maximum) may be within the facility with the majority of them, administrative personnel.

2. RMTC requested as-built drawings of the dining hall, snack bar, computer rooms, and hot water heating system. IAHK-ENG provided RMTC with an index of their available sepias. RMTC will review the index and notify IAHK-ENG which of the drawings are required for this study.

3. RMTC will set the schedule of field investigations and notify IAHK-ENG.

4. IAHK-ENG will assist the A/E during the field survey pending availability of manpower from the IAHK-ENG office. Assistance shall include coordination with the security personnel of FSK, manpower services for work in areas inaccessible to RMTC and providing further information necessary for the investigation.

A brief tour of the designated areas was made by the attendees to obtain a better concept of the designated areas to be surveyed. The following items were noted:

1. The dining hall serves 4 meals a day with the fourth one served at 01:00 hours. The approximate number of meals served at each meal period will be investigated by IAHK-ENG and provided to RMTC at a later date. The snack bar is operated 24 hours a day. The exhaust system of the snack bar is separate from the exhaust system of the dining facility.

2. An oil-fired hot water heater is currently engaged for heating domestic hot water. It appears that a liquid chiller functioning as a heat recovery unit preheats the incoming water. There are individual electric hot water heaters in remote areas of the facility. IAHK-ENG will provide further information as necessary to supplement the as-built drawings.

3. The access tunnel is used for vehicles as well as foot traffic. The ventilating system is provided with overhead duct work and side air inlets. Lighting was provided on a single side of the tunnel.

4. The computer rooms are restricted areas with limited access to the A/E.

5. The electrical consultant will investigate the parking area and upper fenced area during the field survey.

6. The microwave facility is a prefabricated container type room located in the upper exhaust tunnel. The room is conditioned with a window type A/C unit and is normally not occupied.

7. Outside air is provided via the intake tunnel to four (4) ventilation fans. One (1) fan was energized, providing outside air maintaining a positive pressure. The exhaust air of the facility is consolidated in the power plant and exhausted by a centrifugal exhaust fan. The exhaust tunnel is divided into upper an lower halves with the exhaust air flowing through the lower half of the tunnel.

Yong Jin Kim, P.E.
Project Manager

GC:G-1

cc: G. Keys, DFE
W. Hashiro, FE Support Br., POD
A. Yamaoka, NO&A

FILE COPY

420 WAIAKAMILO RD. • SUITE 411
HONOLULU, HAWAII 96817-4941
(808) 842-1133
FAX (808) 842-1937

R. M. TOWILL CORPORATION

Engineering • Planning • Photogrammetry • Surveying • Construction Management • Energy Systems

July 15, 1988

Department of the Army
Pacific Ocean Division
Corps of Engineers
Building 230
Fort Shafter, Hawaii 96858-5440

Attention: Mr. Rudy Mina

Gentlemen:

SUBJECT: Energy Engineering Analysis Program (EEAP)
U.S. Army Field Station, Kunia, Hawaii
Contract No. DACA83-86-D-0101, D.O. 0005

This is to confirm our telephone conversation with Mr. George Keys of DFE with regard to the programming documents for the subject project. The following items were discussed and agreed:

1. The estimated construction cost of recommended ECO's is less than $100,000. Therefore, non-ECIP funds of FY89, such as the OMA Fund will be applied to the implementation of recommended ECO's.

2. For the programming documents of the recommended ECO's, DA Form 4283 will be prepared and attached to each ECIP analysis in Appendix B as presented in the previous Army EEA program.

Should you have any questions regarding this matter, please contact us at 842-1133.

Very truly yours,

Yong-Jin Kim, P.E.
Project Manager

YJK:G-1
cc: George Keys, DFE

yjkltrrm

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

July 28, 1988

Facilities Engineering
Support Branch

R. M. Towill Corporation
420 Waiakamilo Road
Suite 411
Honolulu, Hawaii 96817-4941

Gentlemen:

Reference is made to your Indefinite Delivery Architect-Engineer Services (Mechanical) Contract No. DACA83-86-D-0101, D. O. 0005, Energy Engineering Analysis Program (EEAP) U.S. Army Field Station, Kunia, Hawaii.

The attached interim report review comments (21 sheets) from Huntsville Division, the Directorate of Facilities Engineering, and Pacific Ocean Division are provided for your action.

All review comments shall be annotated to indicate your review actions, and be forwarded to this office no later than August 8, 1988.

Questions regarding the above should be directed to Mr. Rudy Mina, the Government Project Engineer, at 438-1682/1776.

Sincerely,

Paul Mizue
Authorized Representative of
the Contracting Officer

Attachments

420 WAIAKAMILO RD. • SUITE 411
HONOLULU, HAWAII 96817-4941
(808) 842-1133
FAX (808) 842-1937

R. M. TOWILL CORPORATION

Engineering • Planning • Photogrammetry • Surveying • Construction Management • Energy Systems

August 8, 1988

Department of the Army
Pacific Ocean Division
Corps of Engineers
Building 230
Fort Shafter, Hawaii 96858-5440

Attention: Mr. Rudy Mina

Gentlemen:

SUBJECT: Energy Engineering Analysis Program (EEAP)
U.S. Army Field Station, Kunia, Hawaii
Contract No. DACA83-86-D-0101, D.O. 0005

Submitted herewith are the annotated comment sheets as requested by your letter dated July 28, 1988. Should you have any questions, please contact us at 842-1133.

Very truly yours,

Yong Jin Kim, P.E.
Project Manager

YJK:G-1

cc: G. Oyama

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

October 16, 1988

REPLY TO
ATTENTION OF
Military Branch

R.M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

Gentlemen:

Reference is made to your Indefinite-Delivery Architect-Engineer Services (Mechnical) Contract No. DACA83-86-D-0101, D.O. 0005, Energy Engineering Analysis Program (EEAP) U.S. Army Field Station, Kunia, Hawaii.

Attached are the Huntsville Engineer Division's review notes, dated 22 September 1988, to your annotated comments for the interim submittal of the subject EEAP project. The Engineering Technical Letter (ETL) 87-7 was provided to you as reference only. Paragraph 10e, Annex B to the Scope of Work provided the Energy Conservation Investment Program (ECIP) guidance which is to be used per paragraph 2.5 of the Scope of Work. The ECIP guidance shall be used for all of the Huntsville Engineer District comments. The ECOs listed in Annexes A and B of the Scope of Work were not to be construed as all inclusive. Other ECOs such as the use of reflectors should be addressed for their feasibility application and a statement should be included in the report to ensure that all feasible ECOs were considered. All explanations or clarifications pertinent to the project should be integrated into the report.

Also attached are the Directorate of Facilities Engineering's review notes to your annotated comments for the interim submittal of the subject EEAP project which requires incorporation into the final report.

All review comments shall be annotated to indicate your review actions, and be forwarded to this office no later than October 22, 1988.

Questions regarding the above should be directed to Ms. Lorrie Higa, Project Engineer, at 438-6937 or 438-1776.

Sincerely,

Paul Mizue
Authorized Representative of
the Contracting Officer

Attachments

APPENDIX B

APPLICABLE ECO's ANALYSIS

TABLE OF CONTENTS

ECO No.	Description	Page
M-1	Timeclock for A/C System, Dining Area	B-1
M-2	Convert A/C to Chilled Water	B-16
M-3	Consolidate Domestic Hot Water	B-24
M-4	Timeclock for Ventilation System	B-30
M-5	Improve Tunnel Ventilation	B-39
E-1	Install Dimmers for Computer Area	B-48
E-2	Replace Lighting Fixtures, Power Plant	B-55
E-3	Replace Lighting Fixtures, A/C Plant	B-64
E-4	Replace Lighting Fixtures, A/C Plant	B-71
E-5	Replace Lighting Fixtures, Perimeter Fence	B-78

DESIGN SHEET

Project Title EEAP / KUNIA Job No.: Page 1 of

Location OAHU, HAWAII Prepared By: G. C. Date APR. 88

Item ECO M-1 Checked By: Y. J. K. Date APR. 88

TIME CLOCK CONTROL OF A/C SYSTEM IN DINING AREA

EXISTING CONDITION

EXISTING AIR HANDLING UNIT WITH CHILLED WATER COIL IS OPERATING AS FOLLOWS:

OPERATING HOURS:	24 HRS PER DAY
OPERATING DAYS:	7 DAYS PER WEEK
OPERATING SEASONS:	ALL YEAR AROUND

ENERGY CONSUMPTION IS CALCULATED BY IN-HOUSE COMPUTER PROGRAM BASED ON MODIFIED BIN-METHOD. SEE ATTACHED ENERGY CALCULATIONS.

BASIS OF A/C ENERGY CALCULATIONS

NO BUILDING ENVELOPE HEAT GAIN	
MAX. NO. OF OCCUPANTS =	150
MIN. OUTSIDE AIR =	15 CFM/PERSON
LIGHTING LOAD =	6.6 KW
OTHER EQUIP LOAD =	1 W/S.F.
TOTAL SUPPLY AIR =	400 CFM/TON
INSIDE COND. =	78°FDB, 50% RH
OUTSIDE COND. =	86°FDB, 73°FWB
HUMAN HEAT GAIN =	580 BTU/HR/PERSON

ENERGY CONSUMPTION: 83,167 KWH/YR.
283.85 MBTU/YR

Project Title EEAP/KUNIA Job No.: Page 2 of

Location OAHU, HAWAII Prepared By: G. C. Date APR. 88

Item ECO M-1 Checked By: Y.J.K. Date APR. 88

IMPROVED CONDITION

PROVIDE A TIMECLOCK CONTROL WITH BY-PASS TIMER ON EXISTING AIR HANDLING UNIT.

OPERATING HOURS : 14 HOURS PER DAY
0:00 AM - 3:00 AM
5:00 AM - 8:00 AM
10:00 AM - 2:00 PM
4:00 PM - 8:00 PM

OPERATING DAYS : 7 DAYS PER WEEK

OPERATING SEASONS: ALL YEAR AROUND

5% OF FULL LOAD AND OPERATING HOURS ARE ADDED FOR UNSCHEDULED OPERATION BY BY-PASS TIMER.

ENERGY CONSUMPTION : 56,558 KWH/YR
193.03 MBTU/YR

THIS ECO IS TO LIMIT THE OPERATION OF AIR HANDLING UNIT ONLY FOR THE PERIODS OF DINING SERVICE BY PROVIDING A TIMECLOCK TO THE SYSTEM.

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S. ARMY FIELD STATION
LOCATION: KUNIA, OAHU, HAWAII

ECO NAME: TIME CLOCK CONTROL FOR A/C SYSTEM

PROJECT CONSTRUCTION COST:

PER ATTACHED COST ESTIMATE	$1,882

PROJECT TOTAL INVESTMENT:

PER ATTACHED LCC ANALYSIS	$1,922

ANNUAL SAVINGS:

	FUEL OIL/YR		ELECTRICITY/YR		TOTAL/YR	
	MBTU	$	MBTU	$	MBTU	$
EXISTING	0.00	$0	283.85	$5,240	283.85	$5,240
IMPROVED	0.00	$0	193.03	$3,563	193.03	$3,563
SAVINGS	0.00	$0	90.82	$1,677	90.82	$1,677
OTHER SAVINGS	0.00	$0	0.00	$0	0.00	$0
TOTAL SAVINGS	0.00	$0	90.82	$1,677	90.82	$1,677

SAVINGS - INVESTMENT RATIO (SIR):

PER ATTACHED LCC ANALYSIS	7.00

SIMPLE PAYBACK PERIOD:

TOTAL INVESTMENT/ANNUAL SAVINGS

$1,922 / $1,677 /YR = 1.1 YRS

ANNUAL FULL LOAD HOURS WEATHER DATA REF.: TM 5-785

BUILDING: U.S.ARMY FIELD STATION
LOCATION: KUNIA, HAWAII

COOLING SEASON - ALL YEAR, BARBER'S POINT NAVAL AIR STATION

TEMP RANGE	01-08	09-16	17-24	TOTAL	% OF MAX. LOAD
95-99	0	0	0	0	0
90-94	0	1	0	1	1.00
85-89	0	219	14	233	1.00
80-84	19	1332	364	1715	0.60
75-79	550	1036	1205	2791	0.20
70-74	1492	290	1035	2817	0
65-69	710	39	273	1022	0
60-64	129	2	22	153	0
55-59	16	0	2	18	0
50-54	2	0	0	2	0
45-49	0	0	0	0	0
TOTAL HRS	2918	2919	2915	8752	

24 HRS/7 DAYS/WK

FULL LOAD HRS	121	1226	473	1820
OPERATING HRS	2918	2919	2915	8752

ADJUST TO KUNIA STATION FROM BARBER'S PT. NAS
USE RATIO OF ANNUAL COOLING DEGREE DAYS: (2821/3929) = 0.72

ADJUSTED FULL LOAD HRS	87	883	341	1311
OPERATING HRS	2918	2919	2919	8752

EXISTING: 24 HRS/7 DAYS/WK

FULL LOAD HRS	1311
OPERATING HRS	8752

IMPROVED: 14 HRS/7 DAYS/WK PLUS 5% FOR UNSCHEDULED OPERATION

FULL LOAD HRS [87*(6/8) + 883*(4/8) + 341*(4/8)] X 1.05	711
OPERATING HRS (14 X 7 X 52) X 1.05	5351

ENERGY ENGINEERING ANALYSIS - LIGHTING PROFILE

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: DINING AREA, 3RD FLOOR

ECO NAME: TIMECLOCK CONTROL FOR A/C SYSTEM
CONDITION: EXISTING

MAXIMUM LIGHTING LOAD: 6.6 KW

FRACTION OF MAXIMUM (0.0 - 1.00)								
HOUR	SUN]	MON	TUE	WED	THU	FRI	SAT	HOLIDAY
1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
9	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
10	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
11	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
12	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
13	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
14	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
16	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
17	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
18	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
19	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
20	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
21	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
22	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
23	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
24	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
TOTAL	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0

TOTAL PER UNIT KW HOUR/WEEK 133 HRS/WK
TOTAL PER UNIT KW HOUR/YEAR 6,916 HRS/YR

ENERGY ENGINEERING ANALYSIS - OCCUPANT PROFILE

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: DINING AREA, 3RD FLOOR

ECO NAME: TIMECLOCK CONTROL FOR A/C SYSTEM
CONDITION: EXISTING

MAXIMUM NUMBER OF OCCUPANTS: 150

	FRACTION OF MAXIMUM (0.0 - 1.00)							
HOUR	SUN	MON	TUE	WED	THU	FRI	SAT	HOLIDAY
1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
7	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
8	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2
12	0.3	0.8	0.8	0.8	0.8	0.8	0.3	0.3
13	0.3	0.8	0.8	0.8	0.8	0.8	0.3	0.3
14	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
18	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
19	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
20	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	4.0	5.2	5.2	5.2	5.2	5.2	4.0	4.0

TOTAL OCCUPANT HOUR/WEEK: 34 HRS/WK
TOTAL OCCUPANT HOUR/YEAR: 1,768 HRS/YR

ENERGY ENGINEERING ANALYSIS - LIGHTING PROFILE

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: DINING AREA, 3RD FLOOR

ECO NAME: TIMECLOCK CONTROL FOR A/C SYSTEM
CONDITION: IMPROVED

MAXIMUM LIGHTING LOAD: 6.6 KW

	FRACTION OF MAXIMUM (0.0 - 1.00)							
HOUR	SUN	MON	TUE	WED	THU	FRI	SAT	HOLIDAY
1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
9	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
10	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
11	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
12	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
13	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
14	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
16	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
17	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
18	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
19	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
20	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
21	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
22	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
23	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
24	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
TOTAL	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0

TOTAL PER UNIT KW HOUR/WEEK 98 HRS/WK
TOTAL PER UNIT KW HOUR/YEAR 5,096 HRS/YR

ENERGY ENGINEERING ANALYSIS - OCCUPANT PROFILE

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: DINING AREA, 3RD FLOOR

ECO NAME: TIMECLOCK CONTROL FOR A/C SYSTEM
CONDITION: IMPROVED

MAXIMUM NUMBER OF OCCUPANTS: 150

	FRACTION OF MAXIMUM (0.0 - 1.00)							
HOUR	SUN	MON	TUE	WED	THU	FRI	SAT	HOLIDAY
1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
7	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
8	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2
12	0.3	0.8	0.8	0.8	0.8	0.8	0.3	0.3
13	0.3	0.8	0.8	0.8	0.8	0.8	0.3	0.3
14	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
18	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
19	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
20	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	4.0	5.2	5.2	5.2	5.2	5.2	4.0	4.0

TOTAL OCCUPANT HOUR/WEEK: 34 HRS/WK
TOTAL OCCUPANT HOUR/YEAR: 1,768 HRS/YR

AIR CONDITIONING ENERGY ANALYSIS

KUNIA FIELD STA. AREA: DINING AREA, 3RD FLOOR
EXISTING CONDITION: TIME CLOCK CONTROL

NUMBER OF STORIES	=	3	WINDOW U-FACTOR	0	BTUH/SF-F
TOTAL FLOOR AREA	=	7,000 SF	HUMAN HEAT GAIN	580	BTUH/OCC.
AIR-CONDITIONED AREA	=	4,500 SF	OUTSIDE AIR	2,250	CFM
NO. OF OCCUPANTS	=	150	LIGHTING LOAD	6.60	KW
INSIDE TEMPERATURE	=	78 F	EQUIPMENT LOAD	4.50	KW
CONDITIONED VOLUME	=	40,500 CF			

ORIENTATION	NET WALL AREA (SF)	U	WINDOW AREA (SF)	SHADE FACTOR	EXTERIOR SURFACE HEAT TRANSFER PARAMETERS CLTD (DEG F)	SHGF (BTUH/SF)
N	0	0.00	0	0	0	0
S	0	0.00	0	0	0	0
E	0	0.00	0	0	0	0
W	0	0.00	0	0	0	0
ROOF	0	0.00	0	0	0	0
PARTITION	0	0.00	0	0	0	
SHADED WALLS	0	0.00	0	0	0	

HEAT GAIN SUMMARY PEAK BLDG. LOAD OCCURS AT: 1300 HRS

EXTERNAL HEAT GAINS: (BTUH)		INTERNAL HEAT GAINS: (BTUH)			
WALLS	0	HUMAN	87,000		
ROOF	0	LIGHTS	22,526		
WINDOWS - SOLAR	0	EQUIPT	15,359		
WINDOWS - COND	0	OTHER	0		
OUTSIDE AIR	65,340				TOTAL BLDG. LOAD
SUBTOTALS	65,340		124,884	=	190,224 BTUH
					15.9 TONS

COOLING SYSTEM:

OPERATING HOURS	8752 HR/YR	EXISTING CENTRAL SYSTEM CAP.	16.0 TONS
POWER USE-COMPRESSOR	0.79 KW/TON	WINDOW A/C UNITS	0 TONS
POWER USE-AUXILIARIES	0.2 KW/TON	WINDOW A/C AREA	0 SF
POWER USE-AIR HANDLERS	0.40 W/CFM	F.L. OCCUPANCY	1,768 HR/YR
SUPPLY AIR VOLUME	6400 CFM	F.L. LIGHTING	6,916 HR/YR
EXTERNAL F.L. HOURS	1311 HOURS		

ANNUAL ENERGY USED FOR COOLING:

REFRIGERATION	33,014 KWH/YR
AUXILIARIES	27,747 KWH/YR
AIR DISTRIBUTION	22,405 KWH/YR
TOTAL	83,167 KWH/YR

AIR CONDITIONING ENERGY ANALYSIS

KUNIA FIELD STA. AREA: DINING AREA, 3RD FLOOR
IMPROVED CONDITION: TIME CLOCK CONTROL

NUMBER OF STORIES	=	3	WINDOW U-FACTOR	0	BTUH/SF-F
TOTAL FLOOR AREA	=	7,000 SF	HUMAN HEAT GAIN	580	BTUH/OCC.
AIR-CONDITIONED AREA	=	4,500 SF	OUTSIDE AIR	2,250	CFM
NO. OF OCCUPANTS	=	150	LIGHTING LOAD	6.60	KW
INSIDE TEMPERATURE	=	78 F	EQUIPMENT LOAD	4.50	KW
CONDITIONED VOLUME	=	40,500 CF			

ORIENTATION	NET WALL AREA (SF)	U	WINDOW AREA (SF)	SHADE FACTOR	EXTERIOR SURFACE HEAT TRANSFER PARAMETERS CLTD (DEG F)	SHGF (BTUH/SF)
N	0	0.00	0	0	0	0
S	0	0.00	0	0	0	0
E	0	0.00	0	0	0	0
W	0	0.00	0	0	0	0
ROOF	0	0.00	0	0	0	0
PARTITION	0	0.00	0	0	0	
SHADED WALLS	0	0.00	0	0	0	

HEAT GAIN SUMMARY PEAK BLDG. LOAD OCCURS AT: 1300 HRS

EXTERNAL HEAT GAINS: (BTUH)		INTERNAL HEAT GAINS: (BTUH)			
WALLS	0	HUMAN	87,000		
ROOF	0	LIGHTS	22,526		
WINDOWS - SOLAR	0	EQUIPT	15,359		
WINDOWS - COND	0	OTHER	0		
OUTSIDE AIR	65,340				TOTAL BLDG. LOAD
SUBTOTALS	65,340		124,884	=	190,224 BTUH
					15.9 TONS

COOLING SYSTEM:

OPERATING HOURS	5351	HR/YR	EXISTING CENTRAL SYSTEM CAP.	16.0	TONS
POWER USE-COMPRESSOR	0.79	KW/TON	WINDOW A/C UNITS	0	TONS
POWER USE-AUXILIARIES	0.2	KW/TON	WINDOW A/C AREA	0	SF
POWER USE-AIR HANDLERS	0.40	W/CFM	F.L. OCCUPANCY	1,768	HR/YR
SUPPLY AIR VOLUME	6400	CFM	F.L. LIGHTING	5,096	HR/YR
EXTERNAL F.L. HOURS	711	HOURS			

ANNUAL ENERGY USED FOR COOLING:

REFRIGERATION	25,894	KWH/YR
AUXILIARIES	16,965	KWH/YR
AIR DISTRIBUTION	13,699	KWH/YR
TOTAL	56,558	KWH/YR

Project Title EEAP/KUNIA Job No.: _____ Page 1 of 2

Location OAHU, HAWAII Prepared By: GC Date APR. 1988

Item COST ESTIMATE Checked By: YJK Date APR. 1988

OVERHEAD & PROFIT FACTORS

BASED ON THE NATURE OF THE PROJECTS, IT IS MOST LIKELY THE PROJECT WILL BE HANDLED BY A MECHANICAL OR ELECTRICAL CONTRACTOR. SINCE IT IS NOT KNOWN HOW LARGE THE PROJECTS WILL BE GROUPED, IT IS DIFFICULT TO CALCULATE THE OVERHEAD FACTOR. IT IS ASSUMED THAT A 15% OVERHEAD RATE IS PROPER FOR THE PROJECT OF THIS NATURE AND SIZE.

THE PROFIT FACTOR IS 8% AS ESTIMATED ON THE PROFIT FACTOR CALCULATION SHEET.

THEREFORE, THE TOTAL COSTS FOR INDIRECTS IS:

OVERHEAD	15
PROFIT	8
TAX	4.17
BOND	1.00
	28.17

SAY 28%

PROFIT FACTOR

DATE APRIL 1988 SHEET 2 OF 2

RFP/CONTRACT NUMBER EEAP/KUNIA ESTIMATED BY G. C.

CHANGE ORDER CASE NUMBER _____ CHECKED BY Y. J. K.

	FACTOR	RATE	WEIGHT 0.03-0.12	VALUE
1.	DEGREE OF RISK	20	0.7	1.4
2.	RELATIVE DIFFICULTY OF WORK	15	0.7	1.05
3.	SIZE OF JOB	15	0.12	1.8
4.	PERIOD OF PERFORMANCE	15	0.06	0.9
5.	CONTRACTOR'S INVESTMENT	5	0.07	0.35
6.	ASSISTANCE BY GOVERNMENT	5	0.11	0.55
7.	SUBCONTRACTING	25/100	0.08	2.00
				8.05 %
				SAY 8.0 %

REASONS FOR WEIGHTS ASSIGNED

1. AVERAGE RISK
2. AVERAGE DIFFICULTY
3. ASSUMED $100,000 RANGE
4. 12 MONTHS
5. AVERAGE
6. NONE
7. 50%

Project Title EEAP/KUNIA Job No.: _____ Page _____ of _____

Location OAHU, HAWAII Prepared By: G.C Date AUG 1988

Item COST ESTIMATE Checked By: YJK. Date AUG 1988

WAGE RATE CALCULATIONS (PER POD FURNISHED DATA)

1. PLUMBERS/PIPE FITTERS

BASE WAGE RATE	20.00
TAXES & INSURANCE	5.07
FRINGE BENEFITS	8.57
	33.64
30% AREA FACTOR	10.09
	43.73 SAY $44

2. SHEETMETAL WORKER

BASE WAGE RATE	18.75
TAXES & INSURANCE	6.18
FRINGE BENEFITS	10.17
	35.10
30% AREA FACTOR	10.53
	45.63 SAY $47

3. ELECTRICIAN

BASE WAGE RATE	19.40
TAXES & INSURANCE	5.92
FRINGE BENEFITS	9.15
	34.47
30% AREA FACTOR	10.34
	44.81 SAY $45

COST ESTIMATE ANALYSIS
For use of this form, see TM 5-800-2; the proponent agency is USACE.

PROJECT: EEAP/KUNIA	INVITATION/CONTRACTOR:	EFFECTIVE PRICING DATE: APRIL 1988	DATE PREPARED: APRIL 1988
LOCATION: OAHU, HAWAII	CODE (Check one): [X] A [ ] B [ ] C [ ] OTHER ____	DRAWING NO.:	SHEET 1 OF 1 SHEETS
		ESTIMATOR: GC	CHECKED BY: YJK

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
TIMECLOCK CONTROL FOR A/C SYSTEM													
DINING AREA, 3RD FLOOR													
7 DAY TIMECLOCK	1	EA	6.3	6.3	46	290			350	350	640		
BY-PASS SWITCH	1	EA	2.1	2.1	46	97			45	45	142		
THERMOSTAT	1	EA	2.1	2.1	46	97			85	85	182		
WIRING & CONDUIT	100	LF	.09	9.0	44	396			1.10	110	506		
TOTAL DIRECT COST											1470		
O/H & PROFIT, 28%											412		
TOTAL CONSTRUCTION COST											$1882		
TOTAL THIS SHEET													

DA FORM 5418-R, Apr 86

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	KUNIA, HAWAII	REGION NO.:	9
PROJECT TITLE:	EEAP/KUNIA	PROJECT NO.:	
DISCRETE PORTION NAME:	TIME CLOCK CONTROL	FISCAL YEAR:	1988
	DINING AREA, 3RD FL	ANALYSIS DATE:	AUG 1988
PREPARED BY: R.M. TOWILL	CORPORATION	ECONOMIC LIFE IN YRS:	15

1. INVESTMENT

A. CONSTRUCTION COST		1882.00	
B. SIOH	7.5% OF 1A	141.15	
C. DESIGN COST	6.0% OF 1A	112.92	
D. ENERGY CREDIT CALC	((1A+1B+1C) X 0.9)	1922.46	
E. SALVAGE VALUE		0.00	
F. TOTAL INVESTMENT	(1D - 1E)		1922.46

2. ENERGY SAVINGS (+) / COSTS (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST, AND DISCOUNTED SAVINGS

	FUEL	UNIT COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELEC	18.46	90.82	1676.54	8.04	13479.36	
B.							
C.							
D.	TOTAL		90.82	1676.54			13479.36

3. NON ENERGY SAVINGS (+) / COSTS (-)

A. ANNUAL RECURRING (+/-)		0.00	
(1) DISCOUNT FACTOR		9.11	
(2) DISCOUNTED SAVINGS(+)/COST(-)	(3A X 3A1)	0.00	

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS(+) COSTS(-) (1)	YEAR OF OCCURENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS(+)/COSTS(-) (4)
a.	0	0	0	0
b.	0			0
c.	0			0
d. TOTAL	0			0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS(+)/COSTS(-) (3A2+3Bd4) $ 0.00

D. PROJECT NON-ENERGY QUALIFICATION TEST

(1) 25% MAX NON-ENERGY CALC (2D5 X .33)	4448.19

(a) IF 3D1 IS = OR > 3C GO TO ITEM 4
(b) IF 3D1 IS < 3C CALC SIR=(2D5+3D1)/1F
(c) IF 3D1b IS = OR > 1.0 GO TO ITEM 4
(d) IF 3D1b IS < 1.0 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS (2D3+3A+(3B1d/ECONOMIC LIFE))	1676.54
5. TOTAL NET DISCOUNTED SAVINGS/COST (2D5+3C)	13479.36
6. DISCOUNTED SAVINGS RATIO (SIR)=((5.)/1F)=	7.01

DESIGN SHEET

Project Title EEAP/KUNIA Job No.: _____ Page 1 of _____

Location OAHU, HAWAII Prepared By: G.C. Date APR. 88

Item ECO M-2 Checked By: Y.J.K Date APR. 88

CONVERT A/C SYSTEM TO CHILLED WATER SYSTEM FOR MICROWAVE FACILITY.

EXISTING CONDITION

EXISTING A/C SYSTEM AND OPERATING SCHEDULE ARE AS FOLLOWS:

A/C SYSTEM: 2 TON WINDOW TYPE A/C UNIT
1 TON WATER COOLED FLOOR TYPE A/C UNIT
1,200 CFM OF 65°F AIR FROM CENTRAL AHU.

OPERATING HOUR: 24HRS/DAY, 7DAYS/WK, ALL YEAR AROUND

BASIS OF A/C ENERGY CALCULATION

SINCE TUNNEL AIR TEMPERATURE IS LOWER THAN ROOM TEMP., NO ENVELOPE HEAT GAIN.

NO. OF OCCUPANT :	0
MIN. OUTSIDE AIR :	0
LIGHTING LOAD :	1.2 KW
EQUIPMENT LOAD :	7.5 KW
POWER REQUIREMENTS	
COMPRESSOR :	1.46 KW/TON
AUXILIARIES :	0.32 KW/TON
FULL LOAD HOURS :	8,736 HRS
OPERATING HOURS :	8,736 HRS/YR
ENERGY CONSUMPTION :	40,993 KWH/YR
	139.91 MBTU/YR

Project Title EEAP / KUNIA Job No.: Page 2 of

Location OAHU, HAWAII Prepared By: Gr. C. Date APR 88

Item ECO M-2 Checked By: Y.J.K. Date APR 88

IMPROVED CONDITION

PROVIDE TWO CHILLED WATER FAN-COIL UNITS AND CONNECT TO THE CENTRAL CHILLED WATER SYSTEM.

BASIS OF A/C ENERGY CALCULATION

SAME AS EXISTING CONDITION EXCEPT :

POWER REQUIREMENTS

COMPRESSOR	=	0.79 KW/TON
AUXILIARIES	=	0.20 KW/TON
SUPPLY AIR FAN	=	0.10 KW/1000 CFM

ENERGY CONSUMPTION : 25594 KWH/YR

87.35 MBTU/YR

THIS ECO IS TO UPGRADE THE EXISTING A/C SYSTEM, WHICH CONSISTS OF 1EA OF 2 TON WINDOW TYPE A/C UNIT, 1EA OF 1 TON FLOOR TYPE WATER COOLED A/C UNIT AND 1,200 CFM OF COLD AIR SUPPLY FROM A CENTRAL AIR HANDLING UNIT, REPLACING WITH 2EA OF CHILLED WATER FAN-COIL UNITS AND CONNECTING THE SYSTEM TO THE CENTRAL CHILLED WATER SYSTEM.

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S. ARMY FIELD STATION
LOCATION: KUNIA, OAHU, HAWAII

ECO NAME: CONVERT A/C TO CHILLED WATER

PROJECT CONSTRUCTION COST:

PER ATTACHED COST ESTIMATE	$8,484

PROJECT TOTAL INVESTMENT:

PER ATTACHED LCC ANALYSIS	$8,666

ANNUAL SAVINGS:

	FUEL OIL/YR		ELECTRICITY/YR		TOTAL/YR	
	MBTU	$	MBTU	$	MBTU	$
EXISTING	0.00	$0	139.91	$2,583	139.91	$2,583
IMPROVED	0.00	$0	87.35	$1,612	87.35	$1,612
SAVINGS	0.00	$0	52.56	$970	52.56	$970
OTHER SAVINGS	0.00	$0	0.00	$0	0.00	$0
TOTAL SAVINGS	0.00	$0	52.56	$970	52.56	$970

SAVINGS - INVESTMENT RATIO (SIR):

PER ATTACHED LCC ANALYSIS	0.90

SIMPLE PAYBACK PERIOD:

TOTAL INVESTMENT/ANNUAL SAVINGS

$8,666 / $970 /YR = 8.9 YRS

AIR CONDITIONING ENERGY ANALYSIS

KUNIA FIELD STA. AREA: MICROWAVE FACILITY
EXISTING CONDITION: CONVERT A/C TO CHILLED WATER

NUMBER OF STORIES	=	3	WINDOW U-FACTOR	0	BTUH/SF-F
TOTAL FLOOR AREA	=	600 SF	HUMAN HEAT GAIN	0	BTUH/OCC.
AIR-CONDITIONED AREA	=	600 SF	OUTSIDE AIR	0	CFM
NO. OF OCCUPANTS	=	0	LIGHTING LOAD	1.20	KW
INSIDE TEMPERATURE	=	75 F	EQUIPMENT LOAD	7.50	KW
CONDITIONED VOLUME	=	6,000 CF			

ORIENTATION	NET WALL AREA (SF)	U	WINDOW AREA (SF)	SHADE FACTOR	EXTERIOR SURFACE HEAT TRANSFER PARAMETERS CLTD (DEG F)	SHGF (BTUH/SF)
N	0	0.00	0	0	0	0
S	0	0.00	0	0	0	0
E	0	0.00	0	0	0	0
W	0	0.00	0	0	0	0
ROOF	0	0.00	0	0	0	0
PARTITION	0	0.00	0	0	0	
SHADED WALLS	0	0.00	0	0	0	

HEAT GAIN SUMMARY PEAK BLDG. LOAD OCCURS AT: 1300 HRS

EXTERNAL HEAT GAINS: (BTUH)		INTERNAL HEAT GAINS: (BTUH)			
WALLS	0	HUMAN	0		
ROOF	0	LIGHTS	4,096		
WINDOWS - SOLAR	0	EQUIPT	25,598		
WINDOWS - COND	0	OTHER	0		
OUTSIDE AIR	0				TOTAL BLDG. LOAD
SUBTOTALS	0		29,693	=	29,693 BTUH
					2.5 TONS

COOLING SYSTEM:

OPERATING HOURS	8736 HR/YR	EXISTING CENTRAL SYSTEM CAP.	1.0 TONS
POWER USE-COMPRESSOR	1.46 KW/TON	WINDOW A/C UNITS	3 TONS
POWER USE-AUXILIARIES	0.32 KW/TON	WINDOW A/C AREA	600 SF
POWER USE-AIR HANDLERS	0.40 W/CFM	F.L. OCCUPANCY	0 HR/YR
SUPPLY AIR VOLUME	1200 CFM	F.L. LIGHTING	8,736 HR/YR
EXTERNAL F.L. HOURS	8736 HOURS		

ANNUAL ENERGY USED FOR COOLING:

REFRIGERATION	31,560 KWH/YR
AUXILIARIES	6,917 KWH/YR
AIR DISTRIBUTION	2,516 KWH/YR
TOTAL	40,993 KWH/YR

AIR CONDITIONING ENERGY ANALYSIS

KUNIA FIELD STA. AREA: MICROWAVE FACILITY
IMPROVED CONDITION: CONVERT A/C TO CHILLED WATER

NUMBER OF STORIES	=	3	WINDOW U-FACTOR	0	BTUH/SF-F
TOTAL FLOOR AREA	=	600 SF	HUMAN HEAT GAIN	0	BTUH/OCC.
AIR-CONDITIONED AREA	=	600 SF	OUTSIDE AIR	0	CFM
NO. OF OCCUPANTS	=	0	LIGHTING LOAD	1.20	KW
INSIDE TEMPERATURE	=	75 F	EQUIPMENT LOAD	7.50	KW
CONDITIONED VOLUME	=	6,000 CF			

ORIENTATION	NET WALL AREA (SF)	U	WINDOW AREA (SF)	SHADE FACTOR	EXTERIOR SURFACE HEAT TRANSFER PARAMETERS CLTD (DEG F)	SHGF (BTUH/SF)
N	0	0.00	0	0	0	0
S	0	0.00	0	0	0	0
E	0	0.00	0	0	0	0
W	0	0.00	0	0	0	0
ROOF	0	0.00	0	0	0	0
PARTITION	0	0.00	0	0	0	
SHADED WALLS	0	0.00	0	0	0	

HEAT GAIN SUMMARY PEAK BLDG. LOAD OCCURS AT: 1300 HRS

EXTERNAL HEAT GAINS: (BTUH)		INTERNAL HEAT GAINS: (BTUH)			
WALLS	0	HUMAN	0		
ROOF	0	LIGHTS	4,096		
WINDOWS - SOLAR	0	EQUIPT	25,598		
WINDOWS - COND	0	OTHER	0		
OUTSIDE AIR	0				TOTAL BLDG. LOAD
SUBTOTALS	0		29,693	=	29,693 BTUH
					2.5 TONS

COOLING SYSTEM:

OPERATING HOURS	8736 HR/YR	EXISTING CENTRAL SYSTEM CAP.	2.5 TONS
POWER USE-COMPRESSOR	0.79 KW/TON	WINDOW A/C UNITS	0 TONS
POWER USE-AUXILIARIES	0.2 KW/TON	WINDOW A/C AREA	0 SF
POWER USE-AIR HANDLERS	0.40 W/CFM	F.L. OCCUPANCY	0 HR/YR
SUPPLY AIR VOLUME	1200 CFM	F.L. LIGHTING	8,736 HR/YR
EXTERNAL F.L. HOURS	8736 HOURS		

ANNUAL ENERGY USED FOR COOLING:

REFRIGERATION	17,077 KWH/YR
AUXILIARIES	4,323 KWH/YR
AIR DISTRIBUTION	4,193 KWH/YR
TOTAL	25,594 KWH/YR

COST ESTIMATE ANALYSIS
For use of this form, see TM 5-800-2; the proponent agency is USACE.

PROJECT: EEAP/KUNIA	CODE (Check one): [X] A [ ] B [ ] C [ ] OTHER	EFFECTIVE PRICING DATE: APRIL 1988	DATE PREPARED: APRIL 1988
LOCATION: OAHU, HAWAII		DRAWING NO.	SHEET 1 OF 1 SHEETS
		ESTIMATOR: GC	CHECKED BY: YJK

INVITATION/CONTRACTOR:

TASK DESCRIPTION	QUANTITY NO. OF UNITS	QUANTITY UNIT MEAS	LABOR MH UNIT	LABOR TOTAL HRS	LABOR UNIT PRICE	LABOR COST	EQUIPMENT UNIT PRICE	EQUIPMENT COST	MATERIAL UNIT PRICE	MATERIAL COST	TOTAL	SHIPPING UNIT WT	SHIPPING TOTAL WT
CONVERT A/C SYSTEM TO CHILLED WATER SYSTEM													
MICROWAVE FACILITY													
FAN COIL UNIT, 600 CFM	2	EA	6	12	44	528			650	1,300	1828		
PIPING, INCL. INSULATION													
SIZE 1¼"	320	LF	0.25	80	44	3520			4.00	1280	4800		
TOTAL DIRECT COST											6628		
O/H & PROFIT, 28%											1856		
TOTAL CONSTRUCTION COST										$	8484		
TOTAL THIS SHEET													

DA FORM 5418-R, Apr 85

B-21

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	KUNIA, HAWAII	REGION NO.:	9
PROJECT TITLE:	EEAP/KUNIA	PROJECT NO.:	
DISCRETE PORTION NAME:	CONVERT A/C MICROWAVE FAC.	FISCAL YEAR:	1988
		ANALYSIS DATE:	AUG 1988
PREPARED BY: R.M. TOWILL CORPORATION		ECONOMIC LIFE IN YRS:	15

1. INVESTMENT

A. CONSTRUCTION COST		8484.00	
B. SIOH	7.5% OF 1A	636.30	
C. DESIGN COST	6.0% OF 1A	509.04	
D. ENERGY CREDIT CALC	((1A+1B+1C) X 0.9)	8666.41	
E. SALVAGE VALUE		0.00	
F. TOTAL INVESTMENT	(1D - 1E)		8666.41

2. ENERGY SAVINGS (+) / COSTS (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST, AND DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	18.46	52.56	970.26	8.04	7800.87	
B.						
C.						
D. TOTAL		52.56	970.26			7800.87

3. NON ENERGY SAVINGS (+) / COSTS (-)

A. ANNUAL RECURRING (+/-)		0.00
(1) DISCOUNT FACTOR	9.11	
(2) DISCOUNTED SAVINGS(+)/COST(-) (3A X 3A1)		0.00

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS(+) COSTS(-) (1)	YEAR OF OCCURENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS(+)/COSTS(-) (4)
a.	0	0	0	0
b.	0			0
c.	0			0
d. TOTAL	0			0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS(+)/COSTS(-) (3A2+3Bd4) $ 0.00

D. PROJECT NON-ENERGY QUALIFICATION TEST
(1) 25% MAX NON-ENERGY CALC (2D5 X .33) 2574.29
(a) IF 3D1 IS = OR > 3C GO TO ITEM 4
(b) IF 3D1 IS < 3C CALC SIR=(2D5+3D1)/1F
(c) IF 3D1b IS = OR > 1.0 GO TO ITEM 4
(d) IF 3D1b IS < 1.0 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS (2D3+3A+(3B1d/ECONOMIC LIFE))	970.26
5. TOTAL NET DISCOUNTED SAVINGS/COST (2D5+3C)	7800.87
6. DISCOUNTED SAVINGS RATIO (SIR)=((5.)/1F)=	0.90

FACILITIES ENGINEERING WORK REQUEST – XFA, XFB, XFC

For use of this form, see AR 420–17 and DA Pam 420–6; the proponent agency is the Office of the Chief of Engineers.

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	DATE: YR	DATE: MO	DATE: DA	OTHER FUND CITATION	SHORT JOB DESCRIPTION	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
XFA								81	09	01		CONSOLIDATE DHW SYSTEM			

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
XFBC																				

DESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED

a. Remove existing individual electric water heaters and consolidate the remote DHW systems by connecting to the central DHW system of U. S Army Field Station, Kunia, Oahu, Hawaii.

b. This work is to reduce electrical energy consumption by utilizing the central heat pump system which is more efficient than the individual electric water heaters.

DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED

If this work is not accomplished, electrical energy that could saved by the central heat pump system cannot be saved. The U.S. Army will continue to consume and pay for the excess electricity.

This work is to reduce energy waste wat U. S. Army Field Station, Kunia, Oahu, Hawaii.

REQUESTER INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.	SIGNATURE
GEORGE KEYS	DFE, USASCH	655-0791	

PERSON TO CALL FOR ADDITIONAL INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.
YONG-JIN KIM	R. M. TOWILL CORPORATION	842-1133

FORWARD FOR APPROVAL

TO	RECOMMENDED ACTION	ENVIRONMENTAL IMPACT (NO / YES)	ESTIMATED COST	WORK TO BE PERFORMED	FROM
APPROVING AUTHORITY	☐ APPROVAL ☐ DISAPPROVAL	☐ ☐ ENVIRONMENTAL CONSIDERATIONS ☐ ☐ EIS/EIA INITIATED ☐ ☐ EIS/EIA COMPLETED	FUNDED $ ____ WC K $ 12,400 WC L $ ____ WC ___ $ ____ UNFUNDED $ ____ TOTAL $ 12,400	☐ IN-HOUSE ☐ SELF-HELP ☐ CONTRACT ☐ TROOP	FACILITIES ENGINEER DATE

APPROVED FOR DESIGN	SOURCE OF FUNDS
SIGNATURE / DATE	☐ DIRECT ☐ AUTOMATIC REIMB. ☐ FUNDED REIMB.

REMARKS

APPROVAL ACTION

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	ACTION TAKEN	DATE: MO	DATE: DA	SIGNATURE OF APPROVAL AUTHORITY	FORWARDED TO: DESIGN MO	DESIGN DA	ESTIMATOR MO	ESTIMATOR DA
XFC	C					A – APPROVED D – DISAPPROVED							

DA FORM 1 AUG 78 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (ORIGINAL) – PROJECT FILE COPY
PINK – FORWARD TO KEYPUNCH AFTER COMPLETION OF "APPROVAL ACTION" BLOCK
BLUE – SUSPENSE FILE
GREEN – FORWARD TO KEYPUNCH AFTER COMPLETION OF "FORWARD FOR APPROVAL" BLOCK
YELLOW – REQUESTOR'S COPY

DESIGN SHEET

Project Title EEAP/KUNIA Job No.: Page 1 of

Location OAHU/HAWAII Prepared By: G. C. Date APR. 88

Item ECO M-3 Checked By: Y.J.K Date APR. 88

CONSOLIDATE INDIVIDUAL ELECTRIC WATER HEATER TO CENTRAL SYSTEM

EXISTING CONDITION

PRESENTLY THE FACILITY INCLUDES THE FOLLOWING 4 EACH OF ELECTRIC WATER HEATERS FOR REMOTE TOILETS AND SHOWERS.

EWH # 1 : 40 GAL W/ 2- 2.5 KW ELEMENTS

EWH # 2 : 100 GAL W/ 2 - 5 KW ELEMENTS

EWH # 3 : 40 GAL W/ 2- 2.5 KW ELEMENTS

EWH # 4 : 82 GAL W/ 2-2.5 KW ELEMENTS

TOTAL : 262 GAL W/ 25 KW ELEMENTS

THESE WATER HEATERS FOR REMOTE TOILETS AND SHOWERS.

MAX. NO. OF OCCUPANTS IN AREAS = 180
DAILY DEMAND FOR INDUSTRIAL FACILITY = 5GPD/PERSON

DAILY CONSUMPTION = 180 x 5GPD = 900 GPD

ANNUAL CONSUMPTION = 900 GPD x 365 DAYS =
328,500 GAL/YR

ANNUAL ENERGY CONSUMPTION

328,500 GAL x 8.33 x (120°F - 70°F) = 136.82 MBTU/
40,088 KWH/

Project Title EEAP/KUNIA Job No.: Page 2 of

Location OAHU/HAWAII Prepared By: G.C. Date APR. 88

Item ECO M-3 Checked By: Y.J.K. Date APR. 88

IMPROVED CONDITION

DISCONNECT INDIVIDUAL ELECTRIC WATER HEATERS AND CONNECT THE SYSTEMS TO THE CENTRAL DOMESTIC HOT WATER SYSTEM.

THE CENTRAL DOMESTIC HOT WATER SYSTEM IS GENERATING HOT WATER BY A WATER TO WATER HEAT PUMP. ASSUMING COP OF HEAT PUMP IS 3.0, THE ENERGY REQUIRED FOR THE REMOTE SYSTEM IS.

136.82 MBTU ÷ 3.0 = 45.61 MBTU

ADD 10% FOR PIPING HEAT LOSS

45.61 MBTU X 1.1 = 50.16 MBTU = 14,699 KWH

ADD RECIRCULATING PUMPING ENERGY
ASSUME PUMP OPERATE 16 HOURS PER DAY

200W X 1 X 16 HRS X 365 DAYS = 1,168 KWH

TOTAL REQ'D ENERGY =
14,699 KWH + 1,168 KWH = 15,867 KWH/YR
= 54.15 MBTU/YR

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, OAHU, HAWAII

ECO NAME: CONSOLIDATE EWH TO CENTRAL SYSTEM

PROJECT CONSTRUCTION COST:

PER ATTACHED COST ESTIMATE	$15,514

PROJECT TOTAL INVESTMENT:

PER ATTACHED LCC ANALYSIS	$15,847

ANNUAL SAVINGS:

	FUEL OIL/YR MBTU	FUEL OIL/YR $	ELECTRICITY/YR MBTU	ELECTRICITY/YR $	TOTAL/YR MBTU	TOTAL/YR $
EXISTING	0.00	$0	136.82	$2,526	136.82	$2,526
IMPROVED	0.00	$0	54.15	$1,000	54.15	$1,000
SAVINGS	0.00	$0	82.67	$1,526	82.67	$1,526
OTHER SAVINGS	0.00	$0	0.00	$0	0.00	$0
TOTAL SAVINGS	0.00	$0	82.67	$1,526	82.67	$1,526

SAVINGS - INVESTMENT RATIO (SIR):

PER ATTACHED LCC ANALYSIS	1.00

SIMPLE PAYBACK PERIOD:

TOTAL INVESTMENT/ANNUAL SAVINGS

$15,847 / $1,526 /YR = 10.4 YRS

COST ESTIMATE ANALYSIS
For use of this form, see TM 5-800-2; the proponent agency is USACE.

PROJECT: EEAP/KUNIA	INVITATION/CONTRACTOR:	EFFECTIVE PRICING DATE: APRIL 1988	DATE PREPARED: APRIL 1988
LOCATION: OAHU, HAWAII	CODE (Check one): [X] A [ ] B [ ] C [ ] OTHER ____	DRAWING NO.:	SHEET 1 OF 1 SHEETS
		ESTIMATOR: GC	CHECKED BY: YJK

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
CONSOLIDATE INDIVI DUAL ELEC. WATER HEATERS													
TO CENTRAL SYSTEM													
PIPING INCL. INSULATION													
SIZE 1½"	400	LF	0.30	120	44	5280			4.50	1,800	7080		
SIZE ¾"	400	LF	0.18	72	44	3168			2.20	880	4048		
CIRCULATION PUMPS													
⅙ HP	2	EA	4.0	8	44	352			320	640	992		
TOTAL DIRECT COST											12120		
O/H & PROFIT (28%)											3394		
TOTAL CONSTRUCTION COST											$ 15514		
TOTAL THIS SHEET													

DA FORM 5418-R, Apr 86

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	KUNIA, HAWAII	REGION NO.:	9
PROJECT TITLE:	EEAP/KUNIA	PROJECT NO.:	
DISCRETE PORTION NAME:	CONSOLIDATE EWH	FISCAL YEAR:	1988
		ANALYSIS DATE:	AUG 1988
PREPARED BY:	R.M. TOWILL CORPORATION	ECONOMIC LIFE IN YRS:	25

1. INVESTMENT

A. CONSTRUCTION COST		15514.00	
B. SIOH	7.5% OF 1A	1163.55	
C. DESIGN COST	6.0% OF 1A	930.84	
D. ENERGY CREDIT CALC	((1A+1B+1C) X 0.9)	15847.55	
E. SALVAGE VALUE		0.00	
F. TOTAL INVESTMENT	(1D - 1E)		15847.55

2. ENERGY SAVINGS (+) / COSTS (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST, AND DISCOUNTED SAVINGS

	FUEL	UNIT COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELEC	18.46	82.67	1526.09	10.42	15901.84	
B.							
C.							
D.	TOTAL		82.67	1526.09			15901.84

3. NON ENERGY SAVINGS (+) / COSTS (-)

A. ANNUAL RECURRING (+/-)		0.00	
(1) DISCOUNT FACTOR		11.65	
(2) DISCOUNTED SAVINGS(+)/COST(-)	(3A X 3A1)	0.00	

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS(+) COSTS(-) (1)	YEAR OF OCCURENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS(+)/COSTS(-) (4)
a.	0	0	0	0
b.	0			0
c.	0			0
d. TOTAL	0			0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS(+)/COSTS(-) (3A2+3Bd4) $ 0.00

D. PROJECT NON-ENERGY QUALIFICATION TEST

(1) 25% MAX NON-ENERGY CALC (2D5 X .33)	5247.61	
(a) IF 3D1 IS = OR > 3C GO TO ITEM 4		
(b) IF 3D1 IS < 3C CALC SIR=(2D5+3D1)/1F		
(c) IF 3D1b IS = OR > 1.0 GO TO ITEM 4		
(d) IF 3D1b IS < 1.0 PROJECT DOES NOT QUALIFY		

4. FIRST YEAR DOLLAR SAVINGS (2D3+3A+(3B1d/ECONOMIC LIFE))	1526.09
5. TOTAL NET DISCOUNTED SAVINGS/COST (2D5+3C)	15901.84
6. DISCOUNTED SAVINGS RATIO (SIR)=((5.)/1F)=	1.00

FACILITIES ENGINEERING WORK REQUEST – XFA, XFB, XFC

For use of this form, see AR 420–17 and DA Pam 420–6; the proponent agency is the Office of the Chief of Engineers.

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	DATE: YR	DATE: MO	DATE: DA	OTHER FUND CITATION	SHORT JOB DESCRIPTION	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
1 2 3	4	5 6	7 8 9 10 11	12	13	14 15 16 17 18 19	20 21 22	23 24	25 26	27 28	29 30 31 32 33 34 35 36 37 38	39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65	66 67 68 69 70 71	72 73 74	75 76 77 78 79 80
XFA								80	09	01		TIMECLOCK FOR VENT SYSTEM			

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
1 2 3	4	5 6	7 8 9 10 11	12	13	14 15 16 17 18 19	20 21 22	23 24 25 26 27 28	29 30 31	32 33 34 35 36 37	38 39 40	41 42 43 44 45 46	47 48 49	50 51 52 53 54 55	56 57 58	59 60 61 62 63 64	65 66 67	68 69 70 71 72 73 74 75 76 77 78 79 80
XFB	C																	

DESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED

a. Provide timeclock control for the kitchen ventilation system of U.S. Army Field Station, Kunia, Oahu, Hawaii.

b. This work is to cut unnecessary operation of thekitchen ventilation system during non-operating hours by providing a programmable timeclock.

DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED

If this work is not accomplished, electrical energy that could be saved by eliminating unnecessary operation of kitchen ventilation system cannot be saved. The U.S. Army will continue to consume and pay for the excess electricity.

This work is to reduce energy waste at U.S. Army Field Station, Kunia, Oahu, Hawaii.

REQUESTER INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.	SIGNATURE
GEORGE KEYS	DFE, USASCH	655-0791	

PERSON TO CALL FOR ADDITIONAL INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.
YONG-JIN KIM	R. M. TOWILL CORPORATION	842-1133

FORWARD FOR APPROVAL

TO

APPROVING AUTHORITY

RECOMMENDED ACTION
- ☐ APPROVAL
- ☐ DISAPPROVAL

ENVIRONMENTAL IMPACT

NO	YES	
☐	☐	ENVIRONMENTAL CONSIDERATIONS
☐	☐	EIS/EIA INITIATED
☐	☐	EIS/EIA COMPLETED

ESTIMATED COST

FUNDED	$
WC K	$ 15,400
WC L	$
WC	$
UNFUNDED	$
TOTAL	$ 15,400

WORK TO BE PERFORMED
- ☐ IN-HOUSE
- ☐ SELF-HELP
- ☐ CONTRACT
- ☐ TROOP

FROM

FACILITIES ENGINEER

DATE

APPROVED FOR DESIGN

SIGNATURE

DATE

SOURCE OF FUNDS
- ☐ DIRECT
- ☐ AUTOMATIC REIMB.
- ☐ FUNDED REIMB.

APPROVAL ACTION

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	ACTION TAKEN	DATE: MO	DATE: DA	SIGNATURE OF APPROVAL AUTHORITY	FORWARDED TO: DESIGN MO	DESIGN DA	ESTIMATOR MO	ESTIMATOR DA
1 2 3	4	5 6	7 8 9 10 11	12	13 14	A – APPROVED D – DISAPPROVED	15 16	17 18		19 20	21 22	23 24	25 26
XFC	C												

REMARKS

DA FORM 1 AUG 78 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (ORIGINAL) – PROJECT FILE COPY
PINK – FORWARD TO KEYPUNCH AFTER COMPLETION OF "APPROVAL ACTION" BLOCK
BLUE – SUSPENSE FILE
GREEN – FORWARD TO KEYPUNCH AFTER COMPLETION OF "FORWARD FOR APPROVAL" BLOCK
YELLOW – REQUESTOR'S COPY

DESIGN SHEET

Project Title EEAP / KUNIA Job No.: _____ Page 1 of _____

Location OAHU, HAWAII Prepared By: G. C. Date APR. 88

Item ECO M-4 Checked By: Y. J. K. Date APR. 88

TIMECLOCK CONTROL OF KITCHEN EXHAUST SYSTEM

EXISTING CONDITION

EXISTING KITCHEN EXHAUST AIR AND MAKE-UP AIR SYSTEM IS OPERATING AS FOLLOWS:

OPERATING HOURS:	24 HOURS PER DAY
OPERATING DAYS:	7 DAYS PER WEEK
OPERATING SEASONS:	ALL YEAR AROUND
EXHAUST AIR:	13,400 CFM
MAKE-UP AIR:	11,800 CFM
EXHAUST FAN:	10 HP FOR 13,400 CFM
MAKE-UP AIR FAN:	20 HP FOR 20,560 CFM

MAKE-UP AIR SYSTEM IS PROPOSED TO HAVE COOLING COILS TO COOL OUTSIDE AIR FROM 86.0°FDB, 75°FWB TO 55°FDB, 53°FWB, (57 GRAIN/LB DROP).

EXHAUST FAN HP. = 10 HP

SUPPLY FAN HP = $20 \text{ HP} \times \frac{11,800}{20,560} =$ 11.5 HP

TOTAL FAN HP = 21.5 HP

SAY 18 KW

ENERGY CONSUMPTION: 244823 KWH/YR

835.50 MBTU/YR

Project Title EEAP/KUNIA Job No.: Page 2 of

Location OAHU, HAWAII Prepared By: G. C. Date APR 88

Item ECO M-4 Checked By: Y.J.K. Date APR. 88

IMPROVED CONDITION

PROVIDE A TIMECLOCK CONTROL FOR KITCHEN EXHAUST SYSTEM TO DE-ENERGIZE THE SYSTEM WHEN KITCHE IS NOT OPERATING BETWEEN MEALS AND ALSO SHUT OFF THE MAKE-UP AIR PROVIDING MOTORIZED DAMPERS ON SUPPLY AIR DUCT TO KITCHEN AND ADJUST THE SPEED OF SUPPLY AIR FANS.

THE KITCHEN EXHAUST AIR WILL OPERATE AS FOLLOWS:

OPERATING HOURS: 16 HOURS PER DAY

3:00 AM – 7:00 AM
8:00 AM – 12:00 AM
2:00 PM – 6:00 PM
9:00 PM – 1:00 AM

THIS IMPROVEMENT OFFERS NOT ONLY SAVINGS OF KITCHEN EXHAUST FAN ENERGY, ALSO SAVINGS OF COOLING ENERGY FOR MAKE-UP OUTSIDE AIR REDUCING IT'S VOLUME BY KITCHEN EXHAUST AIR (13,400 CFM).

ENERGY CONSUMPTION: 174425 KWH/YR
595.31 MBTU/YR

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S. ARMY FIELD STATION
LOCATION: KUNIA, OAHU, HAWAII

ECO NAME: TIME CLOCK CONTROL FOR KITCHEN EXHAUST SYSTEM

PROJECT CONSTRUCTION COST:

PER ATTACHED COST ESTIMATE	$16,995

PROJECT TOTAL INVESTMENT:

PER ATTACHED LCC ANALYSIS	$17,360

ANNUAL SAVINGS:

	FUEL OIL/YR		ELECTRICITY/YR		TOTAL/YR	
	MBTU	$	MBTU	$	MBTU	$
EXISTING	0.00	$0	835.58	$15,425	835.58	$15,425
IMPROVED	0.00	$0	595.31	$10,989	595.31	$10,989
SAVINGS	0.00	$0	240.27	$4,435	240.27	$4,435
OTHER SAVINGS	0.00	$0	0.00	$0	0.00	$0
TOTAL SAVINGS	0.00	$0	240.27	$4,435	240.27	$4,435

SAVINGS - INVESTMENT RATIO (SIR):

PER ATTACHED LCC ANALYSIS	2.05

SIMPLE PAYBACK PERIOD:

TOTAL INVESTMENT/ANNUAL SAVINGS

$17,360 / $4,435 /YR = 3.9 YRS

ANNUAL FULL LOAD HOURS WEATHER DATA REF.: TM 5-785

BUILDING: U.S.ARMY FIELD STATION
LOCATION: KUNIA, HAWAII

COOLING SEASON - ALL YEAR, BARBER'S POINT NAVAL AIR STATION

TEMP RANGE	01-08	09-16	17-24	TOTAL	% OF MAX. LOAD
95-99	0	0	0	0	0
90-94	0	1	0	1	1.00
85-89	0	219	14	233	1.00
80-84	19	1332	364	1715	0.60
75-79	550	1036	1205	2791	0.20
70-74	1492	290	1035	2817	0
65-69	710	39	273	1022	0
60-64	129	2	22	153	0
55-59	16	0	2	18	0
50-54	2	0	0	2	0
45-49	0	0	0	0	0
TOTAL HRS	2918	2919	2915	8752	

24 HRS/7 DAYS/WK

FULL LOAD HRS	121	1226	473	1820
OPERATING HRS	2918	2919	2915	8752

ADJUST TO KUNIA STATION FROM BARBER'S PT. NAS
USE RATIO OF ANNUAL COOLING DEGREE DAYS: (2821/3929) = 0.72

ADJUSTED FULL LOAD HRS	87	883	341	1311
OPERATING HRS	2918	2919	2919	8752

EXISTING: 24 HRS/7 DAYS/WK

FULL LOAD HRS	1311
OPERATING HRS	8752

IMPROVED: 16 HRS/7 DAYS/WK PLUS 5% FOR UNSCHEDULED OPERATION

FULL LOAD HRS [87*(5/8) + 883*(6/8) + 341*(5/8)] X 1.05	976
OPERATING HRS (16 X 7 X 52) X 1.05	6115

AIR CONDITIONING ENERGY ANALYSIS

KUNIA FIELD STA. AREA: KITCHEN AREA, 3RD FLOOR
EXISTING CONDITION: TIME CLOCK CONTROL FOR KITCHEN EXHAUST

NUMBER OF STORIES	=	3	WINDOW U-FACTOR	0	BTUH/SF-F
TOTAL FLOOR AREA	=	2,500 SF	HUMAN HEAT GAIN	0	BTUH/OCC.
AIR-CONDITIONED AREA	=	2,500 SF	OUTSIDE AIR	11,800	CFM
NO. OF OCCUPANTS	=	0	LIGHTING LOAD	0.00	KW
INSIDE TEMPERATURE	=	55 F	EQUIPMENT LOAD	0.00	KW
CONDITIONED VOLUME	=	22,500 CF			

ORIENTATION	NET WALL AREA (SF)	U	WINDOW AREA (SF)	SHADE FACTOR	EXTERIOR SURFACE HEAT TRANSFER PARAMETERS CLTD (DEG F)	SHGF (BTUH/SF)
N	0	0.00	0	0	0	0
S	0	0.00	0	0	0	0
E	0	0.00	0	0	0	0
W	0	0.00	0	0	0	0
ROOF	0	0.00	0	0	0	0
PARTITION	0	0.00	0	0	0	
SHADED WALLS	0	0.00	0	0	0	

HEAT GAIN SUMMARY PEAK BLDG. LOAD OCCURS AT: 1300 HRS

EXTERNAL HEAT GAINS: (BTUH)		INTERNAL HEAT GAINS: (BTUH)			
WALLS	0	HUMAN	0		
ROOF	0	LIGHTS	0		
WINDOWS - SOLAR	0	EQUIPT	0		
WINDOWS - COND	0	OTHER	0		
OUTSIDE AIR	852,432				TOTAL BLDG. LOAD
SUBTOTALS	852,432		0	=	852,432 BTUH
					71.0 TONS

COOLING SYSTEM:

OPERATING HOURS	8752 HR/YR	EXISTING CENTRAL SYSTEM CAP.	71.0 TONS
POWER USE-COMPRESSOR	0.79 KW/TON	WINDOW A/C UNITS	0 TONS
POWER USE-AUXILIARIES	0.2 KW/TON	WINDOW A/C AREA	0 SF
POWER USE-AIR HANDLERS	0.40 W/CFM	F.L. OCCUPANCY	0 HR/YR
EXHAUST AIR VOLUME	13400 CFM	F.L. LIGHTING	0 HR/YR
EXTERNAL F.L. HOURS	1311 HOURS		

ANNUAL ENERGY USED FOR COOLING:

REFRIGERATION	73,571 KWH/YR
AUXILIARIES	124,341 KWH/YR
AIR DISTRIBUTION	46,911 KWH/YR
TOTAL	244,823 KWH/YR

AIR CONDITIONING ENERGY ANALYSIS

KUNIA FIELD STA. AREA: KITCHEN AREA, 3RD FLOOR
IMPROVED CONDITION: TIME CLOCK CONTROL FOR KITCHEN EXHAUST

NUMBER OF STORIES	=	3	WINDOW U-FACTOR	0	BTUH/SF-F
TOTAL FLOOR AREA	=	2,500 SF	HUMAN HEAT GAIN	0	BTUH/OCC.
AIR-CONDITIONED AREA	=	2,500 SF	OUTSIDE AIR	11,800	CFM
NO. OF OCCUPANTS	=	0	LIGHTING LOAD	0.00	KW
INSIDE TEMPERATURE	=	55 F	EQUIPMENT LOAD	0.00	KW
CONDITIONED VOLUME	=	22,500 CF			

ORIENTATION	NET WALL AREA (SF)	U	WINDOW AREA (SF)	SHADE FACTOR	EXTERIOR SURFACE HEAT TRANSFER PARAMETERS CLTD (DEG F)	SHGF (BTUH/SF)
N	0	0.00	0	0	0	0
S	0	0.00	0	0	0	0
E	0	0.00	0	0	0	0
W	0	0.00	0	0	0	0
ROOF	0	0.00	0	0	0	0
PARTITION	0	0.00	0	0	0	
SHADED WALLS	0	0.00	0	0	0	

HEAT GAIN SUMMARY PEAK BLDG. LOAD OCCURS AT: 1300 HRS

EXTERNAL HEAT GAINS: (BTUH)		INTERNAL HEAT GAINS: (BTUH)			
WALLS	0	HUMAN	0		
ROOF	0	LIGHTS	0		
WINDOWS - SOLAR	0	EQUIPT	0		
WINDOWS - COND	0	OTHER	0		
OUTSIDE AIR	852,432				TOTAL BLDG. LOAD
SUBTOTALS	852,432		0	=	852,432 BTUH
					71.0 TONS

COOLING SYSTEM:

OPERATING HOURS	6115 HR/YR	EXISTING CENTRAL SYSTEM CAP.	71.0 TONS
POWER USE-COMPRESSOR	0.79 KW/TON	WINDOW A/C UNITS	0 TONS
POWER USE-AUXILIARIES	0.2 KW/TON	WINDOW A/C AREA	0 SF
POWER USE-AIR HANDLERS	0.40 W/CFM	F.L. OCCUPANCY	0 HR/YR
EXHAUST AIR VOLUME	13400 CFM	F.L. LIGHTING	0 HR/YR
EXTERNAL F.L. HOURS	976 HOURS		

ANNUAL ENERGY USED FOR COOLING:

REFRIGERATION	54,772 KWH/YR
AUXILIARIES	86,877 KWH/YR
AIR DISTRIBUTION	32,776 KWH/YR
TOTAL	174,425 KWH/YR

COST ESTIMATE ANALYSIS
For use of this form, see TM 5-800-2; the proponent agency is USACE.

PROJECT: EEAP/KUNIA	INVITATION/CONTRACTOR:	EFFECTIVE PRICING DATE: APRIL 1988	DATE PREPARED: APRIL 1988
LOCATION: OAHU, HAWAII	CODE (Check one): [X] A [ ] B [ ] C [ ] OTHER	DRAWING NO.:	SHEET OF SHEETS
		ESTIMATOR: GC	CHECKED BY: YJK

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
TIMECLOCK CONTROL FOR KITCHEN EXHAUST SYSTEM													
KITCHEN AREA, 3RD FLOOR													
7 DAY TIMECLOCK	1	EA	6.3	6.3	46	290			350	350	640		
BY-PASS SWITCH	1	EA	2.1	2.1	46	97			45	45	142		
MOTORIZED DAMPERS													
SIZE 38 X 24	1	EA	6.0	6.0	46	276			180	180	456		
SIZE 18 X 24	1	EA	5.0	5.0	46	230			160	160	390		
MOTOR SPEED CONTROL	4	EA	16.0	64.0	45	2880			1,600	6,400	9280		
WIRING AND RELAYS	460	LF	.09	41.4	45	1863			1.10	506	2369		
TOTAL DIRECT COST											13277		
O/H & PROFIT, 28%											3718		
TOTAL CONSTRUCTION COST											# 16995		
TOTAL THIS SHEET													

DA FORM 5418-R, Apr 86

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	KUNIA, HAWAII	REGION NO.:	9
PROJECT TITLE:	EEAP/KUNIA	PROJECT NO.:	
DISCRETE PORTION NAME:	TIME CLOCK CONTROL KITCHEN EXHAUST SYSTEM	FISCAL YEAR:	1988
		ANALYSIS DATE:	AUG 1988
PREPARED BY: R.M. TOWILL CORPORATION		ECONOMIC LIFE IN YRS:	15

1. INVESTMENT

A. CONSTRUCTION COST		16995.00	
B. SIOH	7.5% OF 1A	1274.63	
C. DESIGN COST	6.0% OF 1A	1019.70	
D. ENERGY CREDIT CALC	((1A+1B+1C) X 0.9)	17360.39	
E. SALVAGE VALUE		0.00	
F. TOTAL INVESTMENT	(1D - 1E)		17360.39

2. ENERGY SAVINGS (+) / COSTS (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST, AND DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	18.46	240.27	4435.38	8.04	35660.49	
B.						
C.						
D. TOTAL		240.27	4435.38			35660.49

3. NON ENERGY SAVINGS (+) / COSTS (-)

A. ANNUAL RECURRING (+/-)			0.00
(1) DISCOUNT FACTOR		9.11	
(2) DISCOUNTED SAVINGS(+)/COST(-)	(3A X 3A1)		0.00

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS(+) COSTS(-) (1)	YEAR OF OCCURENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS(+)/COSTS(-) (4)
a.	0	0	0	0
b.	0			0
c.	0			0
d. TOTAL	0			0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS(+)/COSTS(-) (3A2+3Bd4) $ 0.00

D. PROJECT NON-ENERGY QUALIFICATION TEST

(1) 25% MAX NON-ENERGY CALC (2D5 X .33)	11767.96

(a) IF 3D1 IS = OR > 3C GO TO ITEM 4
(b) IF 3D1 IS < 3C CALC SIR=(2D5+3D1)/1F
(c) IF 3D1b IS = OR > 1.0 GO TO ITEM 4
(d) IF 3D1b IS < 1.0 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS (2D3+3A+(3B1d/ECONOMIC LIFE))	4435.38
5. TOTAL NET DISCOUNTED SAVINGS/COST (2D5+3C)	35660.49
6. DISCOUNTED SAVINGS RATIO (SIR)=((5.)/1F)=	2.05

FACILITIES ENGINEERING WORK REQUEST – XFA, XFB, XFC

For use of this form, see AR 420–17 and DA Pam 420–6; the proponent agency is the Office of the Chief of Engineers.

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	DATE: YR	DATE: MO	DATE: DA	OTHER FUND CITATION	SHORT JOB DESCRIPTION	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
XFA								81	09	01		IMPROVEMENT TO UNNIEL VENTILATION			

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBBR	BUILDING/FACILITY: SUFFIX	BLANK
XFB	C																			

DESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED

a. Replace existing vane axial fans with in-line centrifugal fans for the ventilation of entrance tunnel of U.S. Army Field Station, Kunia, Oahu, Hawaii.

b. This work is to reduce electrical energy consumption by providing higher efficiency fans.

DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED

If this work is not accomplished, electrical energy that could be saved by the higher efficiency fans cannot be saved. The U. S. Army will continue to consume and pay for the excess electricity.

This work is to reduce energy waste at U. S. Army Field Station, Kunia, Oahu, Hawaii.

REQUESTER INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.	SIGNATURE
GEORGE KEYS	DFE, USASCH	655-0791	

PERSON TO CALL FOR ADDITIONAL INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.
YONG-JIN KIM	R. M. TOWILL CORPORATION	842-1133

FORWARD FOR APPROVAL

TO: _____ APPROVING AUTHORITY

RECOMMENDED ACTION: ☐ APPROVAL ☐ DISAPPROVAL

ENVIRONMENTAL IMPACT (NO / YES):
- ☐ ☐ ENVIRONMENTAL CONSIDERATIONS
- ☐ ☐ EIS/EIA INITIATED
- ☐ ☐ EIS/EIA COMPLETED

ESTIMATED COST:
- FUNDED $ _____
- WC K $ 20,300
- WC L $ _____
- WC ___ $ _____
- UNFUNDED $ _____
- TOTAL $ 20,300

WORK TO BE PERFORMED: ☐ IN-HOUSE ☐ SELF-HELP ☐ CONTRACT ☐ TROOP

FROM: _____ FACILITIES ENGINEER _____ DATE

APPROVED FOR DESIGN

_____ SIGNATURE _____ DATE

SOURCE OF FUNDS

☐ DIRECT ☐ AUTOMATIC REIMB. ☐ FUNDED REIMB.

APPROVAL ACTION

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	ACTION TAKEN	DATE: MO	DATE: DA	FORWARDED TO: DESIGN MO	DESIGN DA	ESTIMATOR MO	ESTIMATOR DA
XFC	C					A – APPROVED / D – DISAPPROVED						

_____ SIGNATURE OF APPROVAL AUTHORITY

REMARKS

DA FORM 1 AUG 78 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (ORIGINAL) – PROJECT FILE COPY
PINK – FORWARD TO KEYPUNCH AFTER COMPLETION OF "APPROVAL ACTION" BLOCK
BLUE – SUSPENSE FILE
GREEN – FORWARD TO KEYPUNCH AFTER COMPLETION OF "FORWARD FOR APPROVAL" BLOCK
YELLOW – REQUESTOR'S COPY

Project Title EEAP / KUNIA Job No.: Page 1 of

Location OAHU, HAWAII Prepared By: G. C. Date APR. 88

Item ECO M-5 Checked By: Y. J. K Date APR. 88

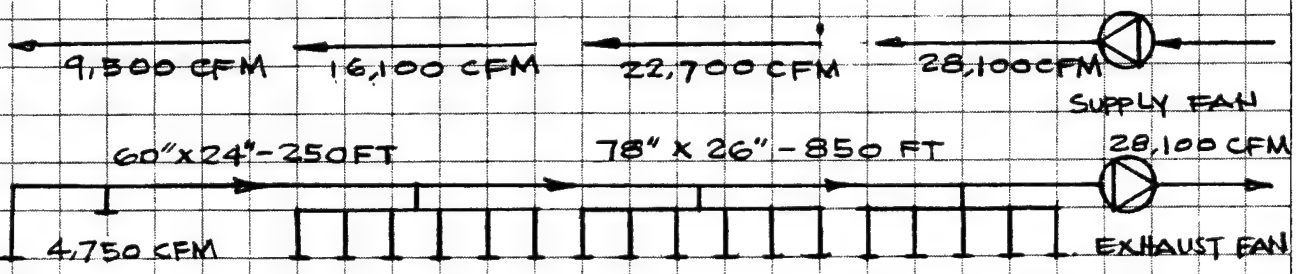
IMPROVE ENTRANCE VENTILATION SYSTEM

EXISTING CONDITION

AS DESCRIBED IN CHAPTER 3, THE EXISTING VENTILATION SYSTEM INCLUDES:

2 EA OF SUPPLY FANS, 28,100 CFM EA, 15 HP EA
(1 EA STAND-BY)
2 EA OF EXHAUST FANS, 28,100 CFM EA, 20 HP EA
(1 EA STAND-BY)
DUCT WORK W/ 62 EA OF 10"x6" OUTLETS AND 2 EA OF 36"x48" GRILLES

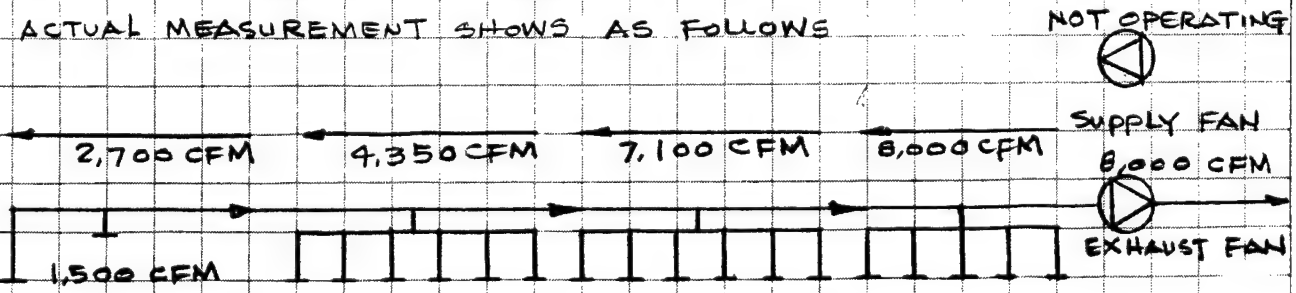
THE ORIGINAL DESIGN INTENDED:



4,750 CFM	22 EA OUTLETS	22 EA OUTLETS	18 EA OUTLETS
TURN-AROUND POINT	@ 300 CFM	@ 300 CFM	@ 300 CFM
	6,600 CFM	6,600 CFM	5,400 CFM

THE ACTUAL OPERATION OBSERVED:

ACTUAL MEASUREMENT SHOWS AS FOLLOWS



1,200 CFM	22 EA OUTLETS	22 EA OUTLETS	18 EA OUTLETS
TURN-AROUND PT.	1,650 CFM	2,750 CFM	900 CFM

AS ILLUSTRATED ABOVE, THE TURN-AROUND POINT WHICH IS THE CRITICAL AREA GETS ONLY 2,700 CFM OUTSIDE AIR WHICH IS ONLY 2 AIR CHANGES PER HOUR.

VOLUME OF TURN AROUND POINT
= 42'W X 18'H X 100'L = 75,600 C.F.

2,700 CFM X 60 ÷ 75,600 C.F. = 2 AIR CHANGES/HR

ABOVE OBSERVATION WAS BASED ON FULL SPEED OPERATION OF THE EXHAUST FAN. ACCORDING TO THE DFE PERSONNEL, FROM 5:00 PM TO 8:00 AM, THE FAN OPERATES AT A HALF SPEED. FOR THE PERIOD THE TURN-AROUND AREA GETS ONLY 1 AIR CHANGE PER HOUR.

IT IS CONSIDERED AS A GOOD DECISION NOT TO OPERATE THE SUPPLY FAN. THE OPERATION OF SUPPLY FAN WOULD NOT HELP THE CIRCULATION, SINCE THE ENTRANCE DOOR IS FULLY OPEN, THE MOST OF SUPPLIED AIR WOULD ESCAPE TO OUTSIDE THROUGH THE ENTRANCE DOOR. IT SHOULD OPERATE ONLY WHEN THE DOOR IS CLOSED.
THE REASON FOR THAT THE SYSTEM IS OPERATING AT 8,000 CFM INSTEAD OF 28,100 CFM AS THE ORIGINAL DESIGN INTENDED IS INTERPRETED AS FOLLOWS;

1. SINCE THE DUCT SYSTEM IS NOT PROPERLY BALANCED, IT SUCKS AIR THROUGH THE AREA HAVING LESS FRICTION.

2 THE EXHAUST FANS CAN NOT PRODUCE ENOUGH STATIC HEAD REQUIRED, AS THE FANS ARE VANE-AXIAL FANS WHICH ARE THE LOW STATIC PRESSURE MACHINE.

Project Title EEAP/KUNIA Job No.: Page 3 of

Location OAHU, HAWAII Prepared By: G. C. Date APR. 88

Item ECO M-5 Checked By: Y.J.K. Date APR. 88

ENERGY CONSUMPTION:

8:00 AM TO 5:00 PM FULL SPEED OPERATION
POWER REQUIREMENT 20 HP = 18 KW

5:00 PM TO 8:00 AM ½ SPEED OPERATION
POWER REQUIREMENT 10 HP = 9 KW

ANNUAL ENERGY CONSUMPTION

= (18 KW x 9 HRS + 9 KW x 15 HRS) X 365 DAYS
= 108,405 KWH/YR
= 369.99 MBTU/YR

Project Title EEAP/KUNIA Job No.: Page 4 of

Location OAHU, HAWAII Prepared By: G. C. Date APR. 88

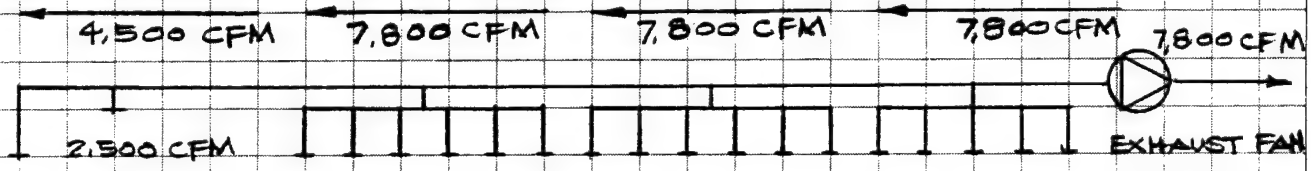
Item ECO M-5 Checked By: Y. J. K. Date APR. 88

IMPROVEMENT RECOMMENDATIONS

THE FOLLOWING TWO STEP IMPROVEMENTS ARE RECOMMENDED

1. IMPROVEMENT FOR MAINTENANCE ITEM.

BLOCK OFF FIRST 40 EXHAUST OUTLETS FROM THE ENTRANCE DOOR. THE ESTIMATED RESULT WOULD BE:

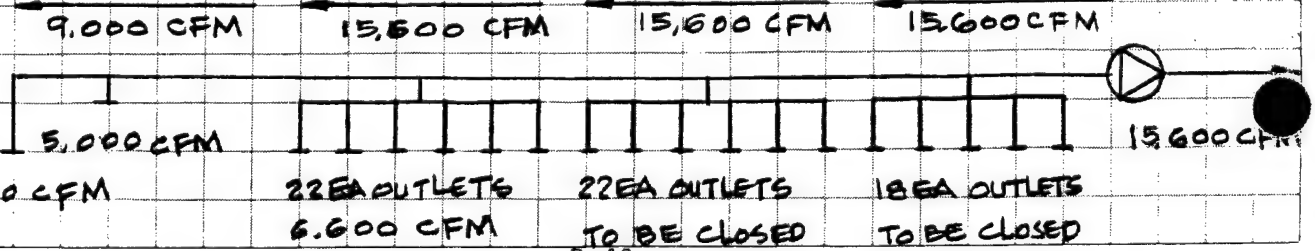


TOTAL VENTILATION RATE WOULD BE LESS THAN THE EXISTING CONDITION, HOWEVER, THE VENTILATION RATE AT THE TURN-AROUND POINT WOULD BE INCREASED FROM 2,700 CFM TO 4,500 CFM WHICH IS 3.6 AIR CHANGES PER HOUR.

4,500 CFM X 60 ÷ 75,600 C.F. = 3.6 AIR CHANGES/HR

2. ECO FOR ECIP ANALYSIS

REPLACE EXISTING EXHAUST FANS WITH IN-LINE CENTRIFUGAL FANS OF HIGHER STATIC PRESSURE. BLOCK-OFF 40 OUTLETS SAME AS FOR STEP 1.



THE TOTAL VENTILATION WILL BE INCREASED FROM 8,000 CFM TO 15,600 CFM AND AT TURN-AROUND POINT AIR CHANGE WILL BE INCREASED FROM 2 AIR CHANGES PER HOUR TO 7 AIR CHANGES PER HOUR.

9,000 CFM X 60 ÷ 75,600 C.F. = 7.1 AIR CHANGE/HR

ENERGY CONSUMPTION:

SELECTED IN-LINE CENTRIFUGAL EXHAUST FANS WITH HIGH EFFICIENCY MOTORS

36IN DIA, 16,000 CFM @ 3" S.P., 15 HP (10.5 BHP)
SAY 10 KW

ANNUAL ENERGY CONSUMPTION

= (10 KW x 9 HRS + 5 KW x 15 HRS) x 365 DAYS
= 60,225 KWH/YR
= 205.55 MBTU/HR

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S. ARMY FIELD STATION
LOCATION: KUNIA, OAHU, HAWAII

ECO NAME: IMPROVE TUNNEL VENTILATION

PROJECT CONSTRUCTION COST:

PER ATTACHED COST ESTIMATE	$21,586

PROJECT TOTAL INVESTMENT:

PER ATTACHED LCC ANALYSIS	$22,050

ANNUAL SAVINGS:

	FUEL OIL/YR		ELECTRICITY/YR		TOTAL/YR	
	MBTU	$	MBTU	$	MBTU	$
EXISTING	0.00	$0	369.99	$6,830	369.99	$6,830
IMPROVED	0.00	$0	205.55	$3,794	205.55	$3,794
SAVINGS	0.00	$0	164.44	$3,036	164.44	$3,036
OTHER SAVINGS	0.00	$0	0.00	$0	0.00	$0
TOTAL SAVINGS	0.00	$0	164.44	$3,036	164.44	$3,036

SAVINGS - INVESTMENT RATIO (SIR):

PER ATTACHED LCC ANALYSIS	1.11

SIMPLE PAYBACK PERIOD:

TOTAL INVESTMENT/ANNUAL SAVINGS

$22,050 / $3,036 /YR = 7.3 YRS

COST ESTIMATE ANALYSIS
For use of this form, see TM 5-800-2; the proponent agency is USACE.

PROJECT: EEAP/KUNIA	INVITATION/CONTRACTOR:	EFFECTIVE PRICING DATE: APRIL 1988	DATE PREPARED: APRIL 1988
LOCATION: OAHU, HAWAII	CODE (Check one): [X] A [ ] B [ ] C [ ] OTHER ____	DRAWING NO.:	SHEET 1 OF 1 SHEETS
		ESTIMATOR: GC	CHECKED BY: YJK

TASK DESCRIPTION	QUANTITY NO. OF UNITS	QUANTITY UNIT MEAS	LABOR MH UNIT	LABOR TOTAL HRS	LABOR UNIT PRICE	LABOR COST	EQUIPMENT UNIT PRICE	EQUIPMENT COST	MATERIAL UNIT PRICE	MATERIAL COST	TOTAL	SHIPPING UNIT WT	SHIPPING TOTAL WT
IMPROVE ENTRANCE TUNNEL VENTILATION													
REMOVAL WORK	1	LS		24	46	1104					1104		
IN-LINE CENTRIFUGAL													
FANS, 15 Hp, 2SPEED	2	EA	30	60	46	2760			6,500	13,000	15760		
TOTAL DIRECT COST											16864		
O/H & PROFIT (28%)											4722		
TOTAL CONSTRUCTION COST										$	21586		
TOTAL THIS SHEET													

DA FORM 5418-R, Apr 86

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	KUNIA, HAWAII	REGION NO.:	9
PROJECT TITLE:	EEAP/KUNIA	PROJECT NO.:	
DISCRETE PORTION NAME:	IMPROVE VENTILATION OF ENTRANCE TUNNEL	FISCAL YEAR:	1988
		ANALYSIS DATE:	AUG 1988
PREPARED BY: R.M. TOWILL	CORPORATION	ECONOMIC LIFE IN YRS:	15

1. INVESTMENT

A. CONSTRUCTION COST		21586.00	
B. SIOH	7.5% OF 1A	1618.95	
C. DESIGN COST	6.0% OF 1A	1295.16	
D. ENERGY CREDIT CALC	((1A+1B+1C) X 0.9)	22050.10	
E. SALVAGE VALUE		0.00	
F. TOTAL INVESTMENT	(1D - 1E)		22050.10

2. ENERGY SAVINGS (+) / COSTS (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST, AND DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	18.46	164.44	3035.56	8.04	24405.92	
B.						
C.						
D. TOTAL		164.44	3035.56			24405.92

3. NON ENERGY SAVINGS (+) / COSTS (-)

A. ANNUAL RECURRING (+/-)		0.00	
(1) DISCOUNT FACTOR		9.11	
(2) DISCOUNTED SAVINGS(+)/COST(-)	(3A X 3A1)	0.00	

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS(+) COSTS(-) (1)	YEAR OF OCCURENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS(+)/COSTS(-) (4)
a.	0	0	0	0
b.	0			0
c.	0			0
d. TOTAL	0			0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS(+)/COSTS(-) (3A2+3Bd4) $ 0.00

D. PROJECT NON-ENERGY QUALIFICATION TEST

(1) 25% MAX NON-ENERGY CALC (2D5 X .33)	8053.95	
(a) IF 3D1 IS = OR > 3C GO TO ITEM 4		
(b) IF 3D1 IS < 3C CALC SIR=(2D5+3D1)/1F		
(c) IF 3D1b IS = OR > 1.0 GO TO ITEM 4		
(d) IF 3D1b IS < 1.0 PROJECT DOES NOT QUALIFY		

4. FIRST YEAR DOLLAR SAVINGS (2D3+3A+(3B1d/ECONOMIC LIFE))	3035.56
5. TOTAL NET DISCOUNTED SAVINGS/COST (2D5+3C)	24405.92
6. DISCOUNTED SAVINGS RATIO (SIR)=((5.)/1F)=	1.11

ENERGY CALCULATION SHEET

METHOD OF ANALYSIS:

PROJECT: EEAP VARIOUS LOCATIONS
BUILDING NO. INDICATED

RELATED TO:
1) TYPE OF FIXTURE OR LAMP
2) HOURS OF USE

SCOPE: PER ECO CATEGORY

ITEM NO.		OBTAINED BY
A.	FIXTURE DATA	
A1	FIXTURE/LAMP TYPE	FIELD INVESTIGATION
A2	NO. OF FIXTURES	FIELD INVESTIGATION
A3	NO. OF LAMPS/FIXTURE	FIELD INVESTIGATION
A4	LUMENS/LAMP	MANUFACTURER'S DATA
A5	WATTS/LAMP	MANUFACTURER'S DATA
A6	WATTS/FIXTURE	MANUFACTURER'S DATA
A7	LAMP LIFE (HRS)	MANUFACTURER'S DATA
B.	INSTALLATION COST	
B1	MATERIAL COST	VENDOR'S ESTIMATE
B2	TOTAL MATERIAL COST	B1 X A2
B3	LABOR UNIT COST	ENGINEERING COST ESTIMATE
B4	TOTAL LABOR COST	B3 X A2
B5	TOTAL COST	B2 + B4
C.	OPERATION AND MAINTENANCE	
C1	RELAMPING MATERIAL COST/FIXTURE	VENDOR'S ESTIMATE
C2	BASE RELAMP LABOR/FIXTURE	ENGINEERING ESTIMATE
C3	RELAMPING LABOR COST/FIXTURE	ENGINEERING ESTIMATE
C4	HOURS USE/YEAR	FIELD INVESTIGATION
C5	ENERGY USE/YEAR (KWH)	A2 X A6 X (C4/1000)
C6	MAINTENANCE COST/YEAR	(C1 + C3) X A2 X (C4/A7)
D.	ECONOMIC ANALYSIS	
D1	ENERGY-SAVINGS/YEAR (KWH)	C5 (EXISTING) - C5 (NEW)
D2	ENERGY-SAVINGS/YEAR (MBTU)	D1 X (.003413 MBTU/KWH)
D3	ENERGY-SAVINGS/YEAR ($)	D2 X $18.46/MBTU
D4	MAINTENANCE COST SAVINGS/YEAR	C6 (EXISTING) - C6 (NEW)
D5	TOTAL SAVINGS/YEAR	D3 + D4

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: COMPUTER AREA

ECO NAME: INSTALL DIMMERS FOR COMPUTER AREA LIGHTING (E-1)

EXISTING CONDITION:

EXISTING FIXTURES IN 3rd FLOOR COMPUTER AREA ARE PARABOLIC LOUVERED FLUORESCENT FIXTURES ON MANUAL SWITCH CONTROL.

OPERATING HOURS/WEEK: 168
OPERATING HOURS/YEAR: 8,736

SEE ATTACHED ENERGY CALCULATION SHEETS

ENERGY CONSUMPTION: 172449 KWH/YR.
586.57 MBTU/YR.

IMPROVED CONDITION:

INSTALL DIMMERS FOR COMPUTER AREA LIGHT FIXTURE CONTROL

OPERATING HOURS/WEEK: 168
OPERATING HOURS/YEAR: 8,736

SEE ATTACHED ENERGY CALCULATION SHEETS

ENERGY CONSUMPTION: 129,336 KWH/YR.
441.42 MBTU/YR.

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, OAHU, HAWAII

ECO NAME: INSTALL DIMMERS FOR COMPUTER AREA LIGHTING

PROJECT CONSTRUCTION COST:

PER ATTACHED COST ESTIMATE	$83,024

PROJECT TOTAL INVESTMENT:

PER ATTACHED LCC ANALYSIS	$84,809

ANNUAL SAVINGS:

	FUEL OIL/YR		ELECTRICITY/YR		TOTAL/YR	
	MBTU	$	MBTU	$	MBTU	$
EXISTING	0.00	$0	588.57	$10,865	588.57	$10,865
IMPROVED	0.00	$0	441.42	$8,149	441.42	$8,149
SAVINGS	0.00	$0	147.15	$2,716	147.15	$2,716
OTHER SAVINGS	0.00	$0	0.00	$0	0.00	$0
TOTAL SAVINGS	0.00	$0	147.15	$2,716	147.15	$2,716

SAVINGS - INVESTMENT RATIO (SIR):

PER ATTACHED LCC ANALYSIS	0.33

SIMPLE PAYBACK PERIOD:

TOTAL INVESTMENT/ANNUAL SAVINGS

$84,809 / $2,716 /YR = 31.2 YRS

LOCATION: KUNIA FIELD STATION, HAWAII

SCOPE: INSTALL DIMMERS FOR COMPUTER AREA LIGHTING (E-1)

ITEM	DESCRIPTION	EXISTING	NEW
A.	FIXTURE DATE:		
	FIXTURE/LAMP TYPE	4-F40T12	4-F40T12
	NO. OF FIXTURES	141	141
	NO. OF LAMPS/FIXTURE	4	3
	LUMENS/LAMP	2775	2775
	WATTS/LAMP	34	34
	WATTS/FIXTURE	140	105
	LAMP LIFE (HRS)	20000	20000
B.	INSTALLATION COST:		
	MATERIAL UNIT COST	NA	NA
	TOTAL MATERIAL COST		60,419
	LABOR UNIT COST		NA
	TOTAL LABOR COST		22,605
	TOTAL COST	✓	83,024
C.	OPERATION & MAINTENANCE:		
	RELAMPING MATERIAL COST/FIXTURE	12.40	12.40
	BASE RELAMPING LABOR MH/FIXTURE	1.0	1.0
	RELAMPING LABOR COST/FIXTURE	20	20
	HRS USE PER YEAR	8736	8736
	ENERGY USE PER YEAR (KWH)	172449	129336
	MAINTENANCE COST/YEAR	1995	1995
D.	ECONOMIC ANALYSIS:		
	ENERGY SAVINGS/YEAR (KWH)	NA	43113
	ENERGY SAVINGS/YEAR (MBTU) (KWH X .003413 MBTU/KWH)		147.14
	ENERGY SAVINGS/YEAR ($)		2716
	MAINTENANCE COST SAVINGS/YEAR		0
	TOTAL SAVINGS/YEAR	✓	2716

ENERGY ENGINEERING ANALYSIS - LIGHTING PROFILE

INSTALLATION: U.S. ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: COMPUTER AREA
ECO NAME: INSTALL DIMMERS FOR COMPUTER AREA LIGHTING
CONDITION: IMPROVED
MAXIMUM LIGHTING LOAD: 22.6 KW

	FRACTION OF MAXIMUM (0.0 - 1.00)							
HOUR	SUN	MON	TUE	WED	THU	FRI	SAT	HOLIDAY
1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
TOTAL	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0

TOTAL PER UNIT KW HOUR/WEEK 168 HRS/WK
TOTAL PER UNIT KW HOUR/YEAR 8,736 HRS/YR

COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

PROJECT: INSTALL DIMMERS FOR COMPUTER AREA LIGHTING	INVITATION/CONTRACTOR	EFFECTIVE PRICING DATE	DATE PREPARED: 4-29-88
LOCATION: KUNIA FIELD STATION, HAWAII	CODE (Check one): [X] A [ ] B [ ] C [ ] OTHER	DRAWING NO.	SHEET | OF | SHEETS
		ESTIMATOR: AY	CHECKED BY: GO

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
REMOVAL WORK	1	LS									4000		
DIMMER SW	22	EA	.8	17.6	45	792			280	6,160	6952		
DIMMING BALLAST	282	EA	.5	141	45	6345			140	39,480	45,825		
BR CKT WIRING	1	LS									8000		
SUBTOTAL											64,777		
PROFIT, OH, TAX BOUND (28.17%)											18,247		
										TOTAL $	83,024		
TOTAL THIS SHEET													

DA FORM 5418-R, Apr 88

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	KUNIA,HAWAII	REGION NO.:	9
PROJECT TITLE:	EEAP/KUNIA	PROJECT NO.:	
DISCRETE PORTION NAME:	INSTALL DIMMERS FOR COMPUTER AREA LTG	FISCAL YEAR:	1988
		ANALYSIS DATE:	MAY 1988
PREPARED BY: R.M. TOWILL CORPORATION		ECONOMIC LIFE IN YRS:	25

1. INVESTMENT

A. CONSTRUCTION COST		$83,024	
B. SIOH	7.5% OF 1A	$6,227	
C. DESIGN COST	6.0% OF 1A	$4,981	
D. ENERGY CREDIT CALC	((1A+1B+1C) X 0.9)	$84,809	
E. SALVAGE VALUE		$0	
F. TOTAL INVESTMENT	(1D - 1E)		$84,809

2. ENERGY SAVINGS (+) / COSTS (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST, AND DISCOUNTED SAVINGS

	FUEL	UNIT COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELEC	18.46	147.14	2716.20	10.42	$28,303	
B.	OIL	5.91	0.00	0.00	16.70	$0	
C.							
D.	TOTAL		147.14	2716.20			$28,303

3. NON ENERGY SAVINGS (+) / COSTS (-)

A. ANNUAL RECURRING (+/-)		0.00	
(1) DISCOUNT FACTOR		11.65	
(2) DISCOUNTED SAVINGS(+)/COST(-)	(3A X 3A1)	0.00	

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS(+) COSTS(-) (1)	YEAR OF OCCURENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS(+)/COSTS(-) (4)
a.	0	0	0	0
b.	0			0
c.	0			0
d. TOTAL	0			0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS(+)/COSTS(-) (3A2+3Bd4)	$	0

D. PROJECT NON-ENERGY QUALIFICATION TEST

(1) 25% MAX NON-ENERGY CALC (2D5 X .33)	$9,340	
(a) IF 3D1 IS = OR > 3C GO TO ITEM 4		
(b) IF 3D1 IS < 3C CALC SIR=(2D5+3D1)/1F	NA	
(c) IF 3D1b IS = OR > 1.0 GO TO ITEM 4		
(d) IF 3D1b IS < 1.0 PROJECT DOES NOT QUALIFY	NA	

4. FIRST YEAR DOLLAR SAVINGS (2D3+3A+(3B1d/ECONOMIC LIFE))	$2,716
5. TOTAL NET DISCOUNTED SAVINGS/COST (2D5+3C)	$28,303
6. DISCOUNTED SAVINGS RATIO (SIR)=((5.)/1F)=	0.33

FACILITIES ENGINEERING WORK REQUEST – XFA, XFB, XFC

For use of this form, see AR 420–17 and DA Pam 420–6; the proponent agency is the Office of the Chief of Engineers.

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	DATE: YR	DATE: MO	DATE: DA	OTHER FUND CITATION	SHORT JOB DESCRIPTION	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
XFA								81	09	01		REPLACE LIGHTING FIXTURES			

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
XFB	C																	

DESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED

a. Replace existing incandescent lighting fixtures with fluorescent fixtures in the Power Plant of U.S. Army Field Station, Kunia, Oahu, Hawaii.

b. This work is to reduce electrical energy consumption by providing high efficiency lighting fixtures.

DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED

If this work is not accomplished, electrical energy that could be saved by the higher efficiency fixtures cannot be saved. The U.S. Army will continue to consume and pay for the excess electricity.

This work is to reduce eneergy waste at U.S. Army Field Station, Kunia, Oahu, Hawaii.

REQUESTER INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.	SIGNATURE
GEORGE KEYS	DFE, USASCH	655-0791	

PERSON TO CALL FOR ADDITIONAL INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.
YONG-JIN KIM	R. M. TOWILL CORPORATION	842-1133

FORWARD FOR APPROVAL

TO	RECOMMENDED ACTION	ENVIRONMENTAL IMPACT	ESTIMATED COST	WORK TO BE PERFORMED	FROM
APPROVING AUTHORITY	☐ APPROVAL ☐ DISAPPROVAL	NO YES ☐ ☐ ENVIRONMENTAL CONSIDERATIONS; ☐ ☐ EIS/EIA INITIATED; ☐ ☐ EIS/EIA COMPLETED	FUNDED $; WC K $ 6,300; WC L $; WC — $; UNFUNDED $; TOTAL $ 6,300	☐ IN-HOUSE ☐ SELF-HELP ☐ CONTRACT ☐ TROOP	FACILITIES ENGINEER; DATE

APPROVED FOR DESIGN

SIGNATURE ____ DATE ____

SOURCE OF FUNDS

☐ DIRECT
☐ AUTOMATIC REIMB.
☐ FUNDED REIMB.

REMARKS

APPROVAL ACTION

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	ACTION TAKEN	DATE: MO	DATE: DA	FORWARDED TO: DESIGN MO	FORWARDED TO: DESIGN DA	FORWARDED TO: ESTIMATOR MO	FORWARDED TO: ESTIMATOR DA
XFC	C					A – APPROVED; D – DISAPPROVED						

SIGNATURE OF APPROVAL AUTHORITY

DA FORM 1 AUG 78 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (ORIGINAL) – PROJECT FILE COPY
PINK – FORWARD TO KEYPUNCH AFTER COMPLETION OF "APPROVAL ACTION" BLOCK
BLUE – SUSPENSE FILE
GREEN – FORWARD TO KEYPUNCH AFTER COMPLETION OF "FORWARD FOR APPROVAL" BLOCK
YELLOW – REQUESTOR'S COPY

ECIP ANALYSIS SUMMARY

INSTALLATION: **U.S.ARMY FIELD STATION**
LOCATION: **KUNIA, HAWAII**
AREA: POWER PLANT

ECO NAME: REPLACE INCANDESCENT FIXTURES W/ FLUORESCENT IN POWER PLANT (E-2)

EXISTING CONDITION:

EXISTING FIXTURES IN POWER PLANT ARE SURFACE MOUNTED INCANDESCENT.

OPERATING HOURS/WEEK	168	
OPERATING HOURS/YEAR:	8,736	
SEE ATTACHED ENERGY CALCULATION SHEETS		
ENERGY CONSUMPTION:	43,680	KWH/YR.
	149.08	MBTU/YR.

IMPROVED CONDITION:

REPLACE INCANDESCENT FIXTURES WITH FLUORESCENT CHANNELS

OPERATING HOURS/WEEK:	168	
OPERATING HOURS/YEAR:	8,736	
SEE ATTACHED ENERGY CALCULATION SHEETS		
ENERGY CONSUMPTION:	17,690	KWH/YR.
	60.38	MBTU/YR.

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, OAHU, HAWAII

ECO NAME: REPLACE INCANDESCENT FIXTURES W/FLUORESCENT IN POWER PLANT

PROJECT CONSTRUCTION COST:

PER ATTACHED COST ESTIMATE	$6,898

PROJECT TOTAL INVESTMENT:

PER ATTACHED LCC ANALYSIS	$7,046

ANNUAL SAVINGS:

	FUEL OIL/YR		ELECTRICITY/YR		TOTAL/YR	
	MBTU	$	MBTU	$	MBTU	$
EXISTING	0.00	$0	149.08	$2,752	149.08	$2,752
IMPROVED	0.00	$0	60.38	$1,115	60.38	$1,115
SAVINGS	0.00	$0	88.70	$1,637	88.70	$1,637
OTHER SAVINGS	0.00	$0	0.00	$2,334	0.00	$2,334
TOTAL SAVINGS	0.00	$0	88.70	$3,971	88.70	$3,971

SAVINGS - INVESTMENT RATIO (SIR):

PER ATTACHED LCC ANALYSIS	6.28

SIMPLE PAYBACK PERIOD:

TOTAL INVESTMENT/ANNUAL SAVINGS

$7,046 / $3,971 /YR = 1.8 YRS

LOCATION: KUNIA FIELD STATION, HAWAII

SCOPE: REPLACE INCANDESCENT FIXTURES W/ FLUORESCENT IN POWER PLANT

ITEM	DESCRIPTION	EXISTING	NEW
A.	FIXTURE DATE:		
	FIXTURE/LAMP TYPE	1-200W/A-23	1-F40T12
	NO. OF FIXTURES	15	15
	NO. OF LAMPS/FIXTURE	1	2
	LUMENS/LAMP	4010	2775
	WATTS/LAMP	200	34
	WATTS/FIXTURE	200	75
	LAMP LIFE (HRS)	750	20000
B.	INSTALLATION COST:		
	MATERIAL UNIT COST	NA	100
	TOTAL MATERIAL COST		1538
	LABOR UNIT COST		112
	TOTAL LABOR COST		1682
	TOTAL COST	↓	3220
C.	OPERATION & MAINTENANCE:		
	RELAMPING MATERIAL COST/FIXTURE	1.70	6.20
	BASE RELAMPING LABOR MH/FIXTURE	.25	.5
	RELAMPING LABOR COST/FIXTURE	5	10
	HRS USE PER YEAR	8736	8736
	ENERGY USE PER YEAR (KWH)	26208	9828
	MAINTENANCE COST/YEAR	1171	106
D.	ECONOMIC ANALYSIS:		
	ENERGY SAVINGS/YEAR (KWH)	NA	16380
	ENERGY SAVINGS/YEAR (MBTU) (KWH X .003413 MBTU/KWH)		55.90
	ENERGY SAVINGS/YEAR ($)		1032
	MAINTENANCE COST SAVINGS/YEAR		1065
	TOTAL SAVINGS/YEAR	↓	2097

LOCATION: KUNIA FIELD STATION, HAWAII

SCOPE: REPLACE INCANDESCENT FIXTURES W/ FLUORESCENT IN POWER PLANT

ITEM	DESCRIPTION	EXISTING	NEW
A.	FIXTURE DATE:		
	FIXTURE/LAMP TYPE	1-100W/A-19	1-F40T12
	NO. OF FIXTURES	20	20
	NO. OF LAMPS/FIXTURE	1	1
	LUMENS/LAMP	1750	2775
	WATTS/LAMP	100	34
	WATTS/FIXTURE	100	45
	LAMP LIFE (HRS)	750	20000
B.	INSTALLATION COST:		
	MATERIAL UNIT COST	NA	90
	TOTAL MATERIAL COST		1794
	LABOR UNIT COST		94
	TOTAL LABOR COST		1884
	TOTAL COST		3678
C.	OPERATION & MAINTENANCE:		
	RELAMPING MATERIAL COST/FIXTURE	.75	3.10
	BASE RELAMPING LABOR MH/FIXTURE	.25	.25
	RELAMPING LABOR COST/FIXTURE	5	5
	HRS USE PER YEAR	8736	8736
	ENERGY USE PER YEAR (KWH)	17472	7862
	MAINTENANCE COST/YEAR	1340	71
D.	ECONOMIC ANALYSIS:		
	ENERGY SAVINGS/YEAR (KWH)	NA	9610
	ENERGY SAVINGS/YEAR (MBTU) (KWH X .003413 MBTU/KWH)		32.80
	ENERGY SAVINGS/YEAR ($)		605
	MAINTENANCE COST SAVINGS/YEAR		1269
	TOTAL SAVINGS/YEAR		1874

ENERGY ENGINEERING ANALYSIS - LIGHTING PROFILE

INSTALLATION: U.S. ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: POWER PLANT
ECO NAME: REPLACE INCANDESCENT FIXTURES W/ FLUORESCENT IN POWER PLANT
CONDITION: IMPROVED
MAXIMUM LIGHTING LOAD: 24.7 KW

	FRACTION OF MAXIMUM (0.0 - 1.00)							
HOUR	SUN	MON	TUE	WED	THU	FRI	SAT	HOLIDAY
1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
TOTAL	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0

TOTAL PER UNIT KW HOUR/WEEK 168 HRS/WK
TOTAL PER UNIT KW HOUR/YEAR 8,736 HRS/YR

COST ESTIMATE ANALYSIS
For use of this form, see TM 5-800-2; the proponent agency is USACE.

INVITATION/CONTRACTOR:

EFFECTIVE PRICING DATE:

DATE PREPARED: 4-29-88

PROJECT: REPLACE INCANDESCENT FIXTURES W/ FLUORESCENT IN POWER PLANT

CODE (Check one): [X] A [ ] B [ ] C [ ] OTHER

DRAWING NO.:

SHEET | OF | SHEETS

LOCATION: KUNIA FIELD STATION, HAWAII

ESTIMATOR: AY

CHECKED BY: GO

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
REMOVE INCAND LT	15	EA	0.3	4.5	45	202.5			—		202.5		
FLUOR LT FIX.	15	EA	1.2	18	45	810			80	1200	2010		
MISC. WORK	1	LS									300		
SUBTOTAL											2512		
PROFIT, OH, TAX, BOND (28.17%)											708		
										TOTAL $	3220		
TOTAL THIS SHEET													

DA FORM 5418-R, Apr 86

COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

PROJECT	REPLACE INCANDESCENT FIXTURES W/ FLUORESCENT IN POWER PLANT
LOCATION	KUNIA FIELD STATION, HAWAII
INVITATION/CONTRACTOR	
CODE (Check one)	[X] A [ ] B [ ] C [ ] OTHER
EFFECTIVE PRICING DATE	
DRAWING NO.	
ESTIMATOR	AY
DATE PREPARED	4-29-88
SHEET	OF SHEETS
CHECKED BY	GO

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
REMOVE INCAND LT	20	EA	0.3	6	45	270			—		270		
FLUOR LT FIXT	20	EA	1.0	20	45	900			70	1400	2300		
MISC WORK	1	LS									300		
SUBTOTAL											2870		
PROFIT, OH, TAX, BOND (20.17%)											808		
										TOTAL $	3678		
TOTAL THIS SHEET													

DA FORM 5418-R, Apr 88

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	KUNIA,HAWAII	REGION NO.:	9
PROJECT TITLE:	EEAP/KUNIA	PROJECT NO.:	
DISCRETE PORTION NAME:	REPLACE INCAND W/ FLUOR IN POWER PLANT	FISCAL YEAR:	1988
		ANALYSIS DATE:	MAY 1988
PREPARED BY: R.M. TOWILL CORPORATION		ECONOMIC LIFE IN YRS:	25

1. INVESTMENT

A. CONSTRUCTION COST		$6,898	
B. SIOH	7.5% OF 1A	$517	
C. DESIGN COST	6.0% OF 1A	$414	
D. ENERGY CREDIT CALC	((1A+1B+1C) X 0.9)	$7,046	
E. SALVAGE VALUE		$0	
F. TOTAL INVESTMENT	(1D - 1E)		$7,046

2. ENERGY SAVINGS (+) / COSTS (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST, AND DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	18.46	88.70	1637.40	10.42	$17,062	
B. OIL	5.91	0.00	0.00	16.70	$0	
C.						
D. TOTAL		88.70	1637.40			$17,062

3. NON ENERGY SAVINGS (+) / COSTS (-)

A. ANNUAL RECURRING (+/-)		2334.00	
(1) DISCOUNT FACTOR		11.65	
(2) DISCOUNTED SAVINGS(+)/COST(-)	(3A X 3A1)	27191.10	

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS(+) COSTS(-) (1)	YEAR OF OCCURENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS(+)/COSTS(-) (4)
a.	0	0	0	0
b.	0			0
c.	0			0
d. TOTAL	0			0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS(+)/COSTS(-) (3A2+3Bd4) $ 27,191

D. PROJECT NON-ENERGY QUALIFICATION TEST

(1) 25% MAX NON-ENERGY CALC (2D5 X .33)	$5,630	
(a) IF 3D1 IS = OR > 3C GO TO ITEM 4		
(b) IF 3D1 IS < 3C CALC SIR=(2D5+3D1)/1F	3.22	
(c) IF 3D1b IS = OR > 1.0 GO TO ITEM 4		
(d) IF 3D1b IS < 1.0 PROJECT DOES NOT QUALIFY	3.22	

4. FIRST YEAR DOLLAR SAVINGS (2D3+3A+(3B1d/ECONOMIC LIFE))	$3,971
5. TOTAL NET DISCOUNTED SAVINGS/COST (2D5+3C)	$44,253
6. DISCOUNTED SAVINGS RATIO (SIR)=((5.)/1F)=	6.28

FACILITIES ENGINEERING WORK REQUEST – XFA, XFB, XFC

For use of this form, see AR 420–17 and DA Pam 420–6; the proponent agency is the Office of the Chief of Engineers.

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	DATE: YR	DATE: MO	DATE: DA	OTHER FUND CITATION	SHORT JOB DESCRIPTION	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
1 2 3	4	5 6	7 8 9 10 11	12	13	14 15 16 17 18 19	20 21 22	23 24	25 26	27 28	29 30 31 32 33 34 35 36 37 38	39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65	66 67 68 69 70 71	72 73 74	75 76 77 78 79 80
X	F	A						8	8	0		9			

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
1 2 3	4	5 6	7 8 9 10 11	12	13	14 15 16 17 18 19	20 21 22	23 24 25 26 27 28	29 30 31	32 33 34 35 36 37	38 39 40	41 42 43 44 45 46	47 48 49	50 51 52 53 54 55	56 57 58	59 60 61 62 63 64	65 66 67	68 69 70 71 72 73	74 75 76 77 78 79 80
X	F	B	C															

DESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED

a. Replace existing incandescent lighting fixtures with fluorescent fixtures in the A/C Plant of U. S. Army Field Station, Kunia, Oahu, Hawaii.

b. This work is to reduce electrical energy consumption by providing higher efficiency lighting fixtures.

DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED

If this work is not accomplished, electrical energy that could be saved by the higher efficiency fixtures cannot be saved. The U. S. Army will continue to consume and pay for the excess electricity.

This work is to reduce energy waste at U.S Army Field Station, Kunia, Oahu, Hawaii.

REQUESTER INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.	SIGNATURE
GEORGE KEYS	DFE, USASCH	655-0791	

PERSON TO CALL FOR ADDITIONAL INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.
YONG-JIN KIM	R. M. TOWILL CORPORATION	842-1133

FORWARD FOR APPROVAL

TO: _____ APPROVING AUTHORITY

RECOMMENDED ACTION: ☐ APPROVAL ☐ DISAPPROVAL

ENVIRONMENTAL IMPACT (NO / YES):
- ☐ ☐ ENVIRONMENTAL CONSIDERATIONS
- ☐ ☐ EIS/EIA INITIATED
- ☐ ☐ EIS/EIA COMPLETED

ESTIMATED COST:
- FUNDED $ _____
- WC K $ 2,700
- WC L $ _____
- WC — $ _____
- UNFUNDED $ _____
- TOTAL $ 2,700

WORK TO BE PERFORMED: ☐ IN–HOUSE ☐ SELF–HELP ☐ CONTRACT ☐ TROOP

FROM: _____ FACILITIES ENGINEER

_____ DATE

APPROVED FOR DESIGN

_____ SIGNATURE _____ DATE

SOURCE OF FUNDS

☐ DIRECT
☐ AUTOMATIC REIMB.
☐ FUNDED REIMB.

REMARKS

APPROVAL ACTION

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	ACTION TAKEN	DATE: MO	DATE: DA	SIGNATURE OF APPROVAL AUTHORITY	FORWARDED TO: DESIGN MO	DESIGN DA	ESTIMATOR MO	ESTIMATOR DA
1 2 3	4	5 6	7 8 9 10 11	12	13	14	15 16	17 18		19 20	21 22	23 24	25 26
X	F	C	C			A – APPROVED D – DISAPPROVED							

DA FORM 1 AUG 78 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (ORIGINAL) – PROJECT FILE COPY
PINK – FORWARD TO KEYPUNCH AFTER COMPLETION OF "APPROVAL ACTION" BLOCK
BLUE – SUSPENSE FILE
GREEN – FORWARD TO KEYPUNCH AFTER COMPLETION OF "FORWARD FOR APPROVAL" BLOCK
YELLOW – REQUESTOR'S COPY

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: A/C PLANT

ECO NAME: REPLACE INCANDESCENT REFLECTOR TYPE FIXTURES W/ FLUORESCENT IN A/C PLANT (E-3)

EXISTING CONDITION:

EXISTING FIXTURES IN A/C PLANT ARE INCANDESCENT REFLECTOR TYPE (STEM MOUNTED)

OPERATING HOURS/WEEK	168	
OPERATING HOURS/YEAR:	8,736	
SEE ATTACHED ENERGY CALCULATION SHEETS		
ENERGY CONSUMPTION:	23,587	KWH/YR.
	80.50	MBTU/YR.

IMPROVED CONDITION:

REPLACE INCANDESCENT FIXTURES WITH FLUORESCENT REFLECTOR TYPE INDUSTRIAL FIXTURES.

OPERATING HOURS/WEEK:	168	
OPERATING HOURS/YEAR:	8,736	
SEE ATTACHED ENERGY CALCULATION SHEETS		
ENERGY CONSUMPTION:	8,256	KWH/YR.
	28.18	MBTU/YR.

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, OAHU, HAWAII

ECO NAME: REPLACE INCANDESCENT FIXTURES W/FLUORESCENT IN A/C PLANT

PROJECT CONSTRUCTION COST:

PER ATTACHED COST ESTIMATE	$2,967

PROJECT TOTAL INVESTMENT:

PER ATTACHED LCC ANALYSIS	$3,031

ANNUAL SAVINGS:

	FUEL OIL/YR MBTU	FUEL OIL/YR $	ELECTRICITY/YR MBTU	ELECTRICITY/YR $	TOTAL/YR MBTU	TOTAL/YR $
EXISTING	0.00	$0	80.50	$1,486	80.50	$1,486
IMPROVED	0.00	$0	28.18	$520	28.18	$520
SAVINGS	0.00	$0	52.32	$966	52.32	$966
OTHER SAVINGS	0.00	$0	0.00	$695	0.00	$695
TOTAL SAVINGS	0.00	$0	52.32	$1,661	52.32	$1,661

SAVINGS - INVESTMENT RATIO (SIR):

PER ATTACHED LCC ANALYSIS	5.99

SIMPLE PAYBACK PERIOD:

TOTAL INVESTMENT/ANNUAL SAVINGS

$3,031 / $1,661 /YR = 1.8 YRS

LOCATION: KUNIA FIELD STATION, HAWAII

SCOPE: REPLACE INCANDESCENT REFLECTOR TYPE FIXTURES W/ FLUORESCENT IN A/C PLANT

ITEM	DESCRIPTION	EXISTING	NEW
A.	FIXTURE DATE:		
	FIXTURE/LAMP TYPE	1-300W/PS-25	1-F40T12
	NO. OF FIXTURES	9	9
	NO. OF LAMPS/FIXTURE	1	3
	LUMENS/LAMP	6300	2775
	WATTS/LAMP	300	34
	WATTS/FIXTURE	300	105
	LAMP LIFE (HRS)	750	20000
B.	INSTALLATION COST:		
	MATERIAL UNIT COST	NA	128
	TOTAL MATERIAL COST		1153
	LABOR UNIT COST		202
	TOTAL LABOR COST		1814
	TOTAL COST		2967
C.	OPERATION & MAINTENANCE:		
	RELAMPING MATERIAL COST/FIXTURE	3.10	9.30
	BASE RELAMPING LABOR MH/FIXTURE	.25	1.5
	RELAMPING LABOR COST/FIXTURE	5	30
	HRS USE PER YEAR	8736	8736
	ENERGY USE PER YEAR (KWH)	23587	9256
	MAINTENANCE COST/YEAR	849	154
D.	ECONOMIC ANALYSIS:		
	ENERGY SAVINGS/YEAR (KWH)	NA	15331
	ENERGY SAVINGS/YEAR (MBTU) (KWH X .003413 MBTU/KWH)		52.32
	ENERGY SAVINGS/YEAR ($)		966
	MAINTENANCE COST SAVINGS/YEAR		695
	TOTAL SAVINGS/YEAR		1661

ENERGY ENGINEERING ANALYSIS - LIGHTING PROFILE

INSTALLATION: U.S. ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: A/C PLANT
ECO NAME: REPLACE INCANDESCENT REFLECTOR TYPE FIXTURES W/ FLUORESCENT IN A/C PLANT
CONDITION: IMPROVED
MAXIMUM LIGHTING LOAD: 8.5 KW

	FRACTION OF MAXIMUM (0.0 - 1.00)							
HOUR	SUN	MON	TUE	WED	THU	FRI	SAT	HOLIDAY
1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24	↓	↓	↓	↓	↓	↓	↓	↓
TOTAL	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0

TOTAL PER UNIT KW HOUR/WEEK 168 HRS/WK
TOTAL PER UNIT KW HOUR/YEAR 8,736 HRS/YR

COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

PROJECT: REPLACE INCANDESCENT REFLECTOR TYPE FIXTURES W/ FLUORESCENT IN A/C PLANT	INVITATION/CONTRACTOR:	EFFECTIVE PRICING DATE:	DATE PREPARED: 4-29-88
LOCATION: KUNIA FIELD STATION, HAWAII	CODE (Check one): [X] A [ ] B [ ] C [ ] OTHER	DRAWING NO.:	SHEET 1 OF 1 SHEETS
		ESTIMATOR: AY	CHECKED BY: GO

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
REMOVE INCAND LT	9	EA	1	9	45	405				—	405		
FLUOR LT FIXT	9	EA	2	18	45	810			100	900	1710		
MISC WORK											200		
SUBTOTAL											2315		
PROFIT, OH, TAX, BOND (28.17%)											652		
										TOTAL $	2967		
TOTAL THIS SHEET													

DA FORM 5418-R, Aug 86

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	KUNIA,HAWAII	REGION NO.:	9
PROJECT TITLE:	EEAP/KUNIA	PROJECT NO.:	
DISCRETE PORTION NAME:	REPLACE INCAND W/ FLUOR IN A/C PLANT	FISCAL YEAR:	1988
		ANALYSIS DATE:	MAY 1988
PREPARED BY: R.M. TOWILL CORPORATION		ECONOMIC LIFE IN YRS:	25

1. INVESTMENT

A. CONSTRUCTION COST		$2,967	
B. SIOH	7.5% OF 1A	$223	
C. DESIGN COST	6.0% OF 1A	$178	
D. ENERGY CREDIT CALC	((1A+1B+1C) X 0.9)	$3,031	
E. SALVAGE VALUE		$0	
F. TOTAL INVESTMENT	(1D - 1E)		$3,031

2. ENERGY SAVINGS (+) / COSTS (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST, AND DISCOUNTED SAVINGS

	FUEL	UNIT COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELEC	18.46	52.32	965.83	10.42	$10,064	
B.	OIL	5.91	0.00	0.00	16.70	$0	
C.							
D.	TOTAL		52.32	965.83			$10,064

3. NON ENERGY SAVINGS (+) / COSTS (-)

A. ANNUAL RECURRING (+/-)		695.00	
(1) DISCOUNT FACTOR		11.65	
(2) DISCOUNTED SAVINGS(+)/COST(-)	(3A X 3A1)	8096.75	

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS(+) COSTS(-) (1)	YEAR OF OCCURENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS(+)/COSTS(-) (4)
a.	0	0	0	0
b.	0			0
c.	0			0
d. TOTAL	0			0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS(+)/COSTS(-) (3A2+3Bd4) $ 8,097

D. PROJECT NON-ENERGY QUALIFICATION TEST

(1) 25% MAX NON-ENERGY CALC (2D5 X .33)	$3,321	
(a) IF 3D1 IS = OR > 3C GO TO ITEM 4		
(b) IF 3D1 IS < 3C CALC SIR=(2D5+3D1)/1F	4.42	
(c) IF 3D1b IS = OR > 1.0 GO TO ITEM 4		
(d) IF 3D1b IS < 1.0 PROJECT DOES NOT QUALIFY	4.42	

4. FIRST YEAR DOLLAR SAVINGS (2D3+3A+(3B1d/ECONOMIC LIFE))	$1,661
5. TOTAL NET DISCOUNTED SAVINGS/COST (2D5+3C)	$18,161
6. DISCOUNTED SAVINGS RATIO (SIR)=((5.)/1F)=	5.99

FACILITIES ENGINEERING WORK REQUEST – XFA, XFB, XFC

For use of this form, see AR 420–17 and DA Pam 420–6; the proponent agency is the Office of the Chief of Engineers.

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	DATE: YR	DATE: MO	DATE: DA	OTHER FUND CITATION	SHORT JOB DESCRIPTION	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
XFA								80	09	01		REPLACE LIGHTING FIXTURES			

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
XFB	C																	

DESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED

a. Replace existing incandescent lighting fixtures with fluorescent fixtures for the motor control center in the A/C Plant of U.S. Army Field Station, Kunia, Oahu, Hawaii.

b. This work is to reduce electrical energy consumption by providing higher efficiency lighting fixtures.

DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED

If this work is not accomplished, electrical energy that could be saved by the higher efficiency fixtures cannot be saved. The U.S Army will continue to consume and pay for the excess electricity.

This work is to reduce energy waste at U.S. Army Field Station, Kunia, Oahu, Hawaii.

REQUESTER INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.	SIGNATURE
GEORGE KEYS	DFE, USASCH	655-0791	

PERSON TO CALL FOR ADDITIONAL INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.
YONG-JIN KIM	R. M. TOWILL CORPORATION	842-1133

FORWARD FOR APPROVAL

TO	RECOMMENDED ACTION	ENVIRONMENTAL IMPACT (NO / YES)	ESTIMATED COST	WORK TO BE PERFORMED	FROM
APPROVING AUTHORITY	☐ APPROVAL ☐ DISAPPROVAL	☐ ☐ ENVIRONMENTAL CONSIDERATIONS; ☐ ☐ EIS/EIA INITIATED; ☐ ☐ EIS/EIA COMPLETED	FUNDED $; WC K $ 900 ; WC L $; WC — $; UNFUNDED $; TOTAL $ 900	☐ IN-HOUSE ☐ SELF-HELP ☐ CONTRACT ☐ TROOP	FACILITIES ENGINEER; DATE

APPROVED FOR DESIGN	SOURCE OF FUNDS
SIGNATURE; DATE	☐ DIRECT ☐ AUTOMATIC REIMB. ☐ FUNDED REIMB.

REMARKS

APPROVAL ACTION

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	ACTION TAKEN	DATE: MO	DATE: DA	SIGNATURE OF APPROVAL AUTHORITY	FORWARDED TO: DESIGN MO	DESIGN DA	ESTIMATOR MO	ESTIMATOR DA
XFC	C					A – APPROVED; D – DISAPPROVED							

DA FORM 1 AUG 78 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (ORIGINAL) – PROJECT FILE COPY
PINK – FORWARD TO KEYPUNCH AFTER COMPLETION OF "APPROVAL ACTION" BLOCK
BLUE – SUSPENSE FILE
GREEN – FORWARD TO KEYPUNCH AFTER COMPLETION OF "FORWARD FOR APPROVAL" BLOCK
YELLOW – REQUESTOR'S COPY

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: A/C PLANT

ECO NAME: REPLACE INCANDESCENT FIXTURES W/ FLUORESCENT FOR A/C PLANT MCC (E-4)

EXISTING CONDITION:

EXISTING FIXTURES IN A/C PLANT NEAR EXST MOTOR CONTROL CENTER (MCC) IS INCANDESCENT WALL MOUNTED FIXTURES.

OPERATING HOURS/WEEK	168	
OPERATING HOURS/YEAR:	8,736	
SEE ATTACHED ENERGY CALCULATION SHEETS		
ENERGY CONSUMPTION:	4,368	KWH/YR.
	14.91	MBTU/YR.

IMPROVED CONDITION:

REPLACE INCANDESCENT FIXTIRES WITH FLUORESCENT CHANNELS

OPERATING HOURS/WEEK:	168	
OPERATING HOURS/YEAR:	8,736	
SEE ATTACHED ENERGY CALCULATION SHEETS		
ENERGY CONSUMPTION:	1,966	KWH/YR.
	6.71	MBTU/YR.

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, OAHU, HAWAII

ECO NAME: REPLACE INCANDESCENT FIXTURES W/FLUORESCENT IN A/C PLANT (MCC)

PROJECT CONSTRUCTION COST:

PER ATTACHED COST ESTIMATE $952

PROJECT TOTAL INVESTMENT:

PER ATTACHED LGC ANALYSIS $972

ANNUAL SAVINGS:

	FUEL OIL/YR MBTU	$	ELECTRICITY/YR MBTU	$	TOTAL/YR MBTU	$
EXISTING	0.00	$0	14.91	$275	14.91	$275
IMPROVED	0.00	$0	6.71	$124	6.71	$124
SAVINGS	0.00	$0	8.20	$151	8.20	$151
OTHER SAVINGS	0.00	$0	0.00	$317	0.00	$317
TOTAL SAVINGS	0.00	$0	8.20	$468	8.20	$468

SAVINGS - INVESTMENT RATIO (SIR):

PER ATTACHED LCC ANALYSIS 5.42

SIMPLE PAYBACK PERIOD:

TOTAL INVESTMENT/ANNUAL SAVINGS

$972 / $468 /YR = 2.1 YRS

LOCATION: KUNIA FIELD STATION, HAWAII

SCOPE: REPLACE INCANDESCENT FIXTURES W/ FLUORESCENT FOR A/C PLANT MCC (E-5)

E-4

ITEM	DESCRIPTION	EXISTING	NEW
A.	FIXTURE DATE:		
	FIXTURE/LAMP TYPE	1-100W/A-19	1-F40T12
	NO. OF FIXTURES	5	5
	NO. OF LAMPS/FIXTURE	1	1
	LUMENS/LAMP	1750	2775
	WATTS/LAMP	100	34
	WATTS/FIXTURE	100	45
	LAMP LIFE (HRS)	750	20000
B.	INSTALLATION COST:		
	MATERIAL UNIT COST	NA	90
	TOTAL MATERIAL COST		449
	LABOR UNIT COST		101
	TOTAL LABOR COST		503
	TOTAL COST	↓	952
C.	OPERATION & MAINTENANCE:		
	RELAMPING MATERIAL COST/FIXTURE	.75	3.10
	BASE RELAMPING LABOR MH/FIXTURE	.25	.25
	RELAMPING LABOR COST/FIXTURE	5	5
	HRS USE PER YEAR	8736	8736
	ENERGY USE PER YEAR (KWH)	4368	1966
	MAINTENANCE COST/YEAR	335	18
D.	ECONOMIC ANALYSIS:		
	ENERGY SAVINGS/YEAR (KWH)	NA	2402
	ENERGY SAVINGS/YEAR (MBTU) (KWH X .003413 MBTU/KWH)		8.20
	ENERGY SAVINGS/YEAR ($)		151
	MAINTENANCE COST SAVINGS/YEAR		317
	TOTAL SAVINGS/YEAR	↓	468

ENERGY ENGINEERING ANALYSIS - LIGHTING PROFILE

INSTALLATION: U.S. ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: A/C PLANT
ECO NAME: REPLACE INCANDESCENT FIXTURES W/ FLUORESCENT FOR A/C PLANT MCC
CONDITION: IMPROVED
MAXIMUM LIGHTING LOAD: 8.5 KW

	FRACTION OF MAXIMUM (0.0 - 1.00)							
HOUR	SUN	MON	TUE	WED	THU	FRI	SAT	HOLIDAY
1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
TOTAL	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0

TOTAL PER UNIT KW HOUR/WEEK 168 HRS/WK
TOTAL PER UNIT KW HOUR/YEAR 8,736 HRS/YR

COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

INVITATION/CONTRACTOR:

EFFECTIVE PRICING DATE:

DATE PREPARED: 4-29-88

PROJECT: REPLACE INCANDESCENT FIXTURES W/ FLUORESCENT FOR A/C PLANT MCC

CODE (Check one): [X] A [ ] B [ ] C [ ] OTHER

DRAWING NO.:

SHEET 1 OF 1 SHEETS

LOCATION: KUNIA FIELD STATION, HAWAII

ESTIMATOR: AY

CHECKED BY: GO

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
REMOVE INCAND LT	5	EA	0.3	1.5	45	68			—		68		
FLUOR LT FIXT	5	EA	1.0	5	45	225			70	350	575		
MISC WORK	1	LS									100		
SUBTOTAL											743		
PROFIT, OH, TAX, BOND (28.17%)											209		
										TOTAL $	952		
TOTAL THIS SHEET													

DA FORM 5418-R, Apr 88

FB-75

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	KUNIA,HAWAII	REGION NO.:	9
PROJECT TITLE:	EEAP/KUNIA	PROJECT NO.:	
DISCRETE PORTION NAME:	REPLACE INCAND W/ FLUOR IN A/C PLANT(MCC)	FISCAL YEAR:	1988
		ANALYSIS DATE:	MAY 1988
PREPARED BY: R.M. TOWILL	CORPORATION	ECONOMIC LIFE IN YRS:	25

1. INVESTMENT

A. CONSTRUCTION COST		$952	
B. SIOH	7.5% OF 1A	$71	
C. DESIGN COST	6.0% OF 1A	$57	
D. ENERGY CREDIT CALC	((1A+1B+1C) X 0.9)	$972	
E. SALVAGE VALUE		$0	
F. TOTAL INVESTMENT	(1D - 1E)		$972

2. ENERGY SAVINGS (+) / COSTS (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST, AND DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	18.46	8.20	151.37	10.42	$1,577	
B. OIL	5.91	0.00	0.00	16.70	$0	
C.						
D. TOTAL		8.20	151.37			$1,577

3. NON ENERGY SAVINGS (+) / COSTS (-)

A. ANNUAL RECURRING (+/-)		317.00	
(1) DISCOUNT FACTOR	11.65		
(2) DISCOUNTED SAVINGS(+)/COST(-)	(3A X 3A1)	3693.05	

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS(+) COSTS(-) (1)	YEAR OF OCCURENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS(+)/COSTS(-) (4)
a.	0	0	0	0
b.	0			0
c.	0			0
d. TOTAL	0			0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS(+)/COSTS(-) (3A2+3Bd4) $ 3,693

D. PROJECT NON-ENERGY QUALIFICATION TEST

(1) 25% MAX NON-ENERGY CALC (2D5 X .33)	$521	
(a) IF 3D1 IS = OR > 3C GO TO ITEM 4		
(b) IF 3D1 IS < 3C CALC SIR=(2D5+3D1)/1F	2.16	
(c) IF 3D1b IS = OR > 1.0 GO TO ITEM 4		
(d) IF 3D1b IS < 1.0 PROJECT DOES NOT QUALIFY	2.16	

4. FIRST YEAR DOLLAR SAVINGS (2D3+3A+(3B1d/ECONOMIC LIFE))	$468
5. TOTAL NET DISCOUNTED SAVINGS/COST (2D5+3C)	$5,270
6. DISCOUNTED SAVINGS RATIO (SIR)=((5.)/1F)=	5.42

FACILITIES ENGINEERING WORK REQUEST – XFA, XFB, XFC

For use of this form, see AR 420–17 and DA Pam 420–6; the proponent agency is the Office of the Chief of Engineers.

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	DATE: YR	DATE: MO	DATE: DA	OTHER FUND CITATION	SHORT JOB DESCRIPTION	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
1 2 3	4	5 6	7 8 9 10 11	12	13	14 15 16 17 18 19	20 21 22	23 24	25 26	27 28	29 30 31 32 33 34 35 36 37 38	39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65	66 67 68 69 70 71	72 73 74	75 76 77 78 79 80
XFA								80	09	01		REPLACE LIGHTING FIXTURES			

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BUILDING/FACILITY: NUMBER	BUILDING/FACILITY: SUFFIX	BLANK
1 2 3	4	5 6	7 8 9 10 11	12	13	14 15 16 17 18 19	20 21 22	23 24 25 26 27 28	29 30 31	32 33 34 35 36 37	38 39 40	41 42 43 44 45 46	47 48 49	50 51 52 53 54 55	56 57 58	59 60 61 62 63 64	65 66 67	68 69 70 71 72 73 74 75 76 77 78 79 80
XFB	C																	

DESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED

a. Replace existing incandescent lighting fixtures with high pressure sodium fixtures along the perimeter fence of U. S. Army Field Station, Kunia, Oahu, Hawaii.

b. This work is to reduce electrical energy consumption by providing higher efficiency lighting fixtures.

DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED

If this work is not accomplished, electrical energy that could be saved by the higher efficiency fixtures cannot be saved. The U. S. Army will conitnue to consume and pay for the excess electricity.

This work is to reduce energy waste at U.S. Army Field Station, Kunia, Oahu, Hawaii.

REQUESTER INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.	SIGNATURE
GEORGE KEYS	DFE, USASCH	655-0791	

PERSON TO CALL FOR ADDITIONAL INFORMATION

NAME	ORGANIZATION	TELEPHONE NO.
YONG-JIN KIM	R. M. TOWILL CORPORATION	842-1133

FORWARD FOR APPROVAL

TO	RECOMMENDED ACTION	ENVIRONMENTAL IMPACT	ESTIMATED COST	WORK TO BE PERFORMED	FROM
APPROVING AUTHORITY	☐ APPROVAL ☐ DISAPPROVAL	NO YES ☐ ☐ ENVIRONMENTAL CONSIDERATIONS ☐ ☐ EIS/EIA INITIATED ☐ ☐ EIS/EIA COMPLETED	FUNDED $ ____ WC K $ 23,300 WC L $ ____ WC ___ $ ____ UNFUNDED $ ____ TOTAL $ 23,300	☐ IN–HOUSE ☐ SELF–HELP ☐ CONTRACT ☐ TROOP	FACILITIES ENGINEER DATE

APPROVED FOR DESIGN

SIGNATURE _____ DATE _____

SOURCE OF FUNDS

☐ DIRECT
☐ AUTOMATIC REIMB.
☐ FUNDED REIMB.

REMARKS

APPROVAL ACTION

TRANS CODE	CHANGE	DOCUMENT NUMBER: REQ ID	DOCUMENT NUMBER: SERIAL NUMBER	DOCUMENT NUMBER: FY	DOCUMENT NUMBER: TYPE	ACTION TAKEN	DATE: MO	DATE: DA	SIGNATURE OF APPROVAL AUTHORITY	FORWARDED TO: DESIGN MO	DESIGN DA	ESTIMATOR MO	ESTIMATOR DA
1 2 3	4	5 6	7 8 9 10 11	12	13	14 A – APPROVED D – DISAPPROVED	15 16	17 18		19 20	21 22	23 24	25 26
XFC	C												

DA FORM 1 AUG 78 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (ORIGINAL) – PROJECT FILE COPY
PINK – FORWARD TO KEYPUNCH AFTER COMPLETION OF "APPROVAL ACTION" BLOCK
BLUE – SUSPENSE FILE
GREEN – FORWARD TO KEYPUNCH AFTER COMPLETION OF "FORWARD FOR APPROVAL" BLOCK
YELLOW – REQUESTOR'S COPY

ECIP ANALYSIS SUMMARY

INSTALLATION: **U.S.ARMY FIELD STATION**
LOCATION: **KUNIA, HAWAII**
AREA: PERIMETER FENCE

ECO NAME: REPLACE INCANDESCENT FIXTURES W/ HPS ALONG PERIMETER FENCE (E-5)

EXISTING CONDITION:

EXISTING FIXTURES ALONG PERIMETER FENCE ARE INCANDESCENT FLOODLIGHTS.

OPERATING HOURS/WEEK: 84
OPERATING HOURS/YEAR: 4,368

SEE ATTACHED ENERGY CALCULATION SHEETS

ENERGY CONSUMPTION: 25,356 KWH/YR.
86.54 MBTU/YR.

IMPROVED CONDITION:

REPLACE INCANDESCENT FIXTURES WITH (HPS) HIGH PRESSURE SODIUM FIXTURES.

OPERATING HOURS/WEEK: 84
OPERATING HOURS/YEAR: 4,368

SEE ATTACHED ENERGY CALCULATION SHEETS

ENERGY CONSUMPTION: 15,965 KWH/YR.
54.49 MBTU/YR.

ECIP ANALYSIS SUMMARY

INSTALLATION: U.S.ARMY FIELD STATION
LOCATION: KUNIA, OAHU, HAWAII

ECO NAME: REPLACE INCANDESCENT FIXTURES W/HPS ALONG PERIMETER FENCE

PROJECT CONSTRUCTION COST:

PER ATTACHED COST ESTIMATE $24,914

PROJECT TOTAL INVESTMENT:

PER ATTACHED LCC ANALYSIS $25,450

ANNUAL SAVINGS:

	FUEL OIL/YR MBTU	$	ELECTRICITY/YR MBTU	$	TOTAL/YR MBTU	$
EXISTING	0.00	$0	86.54	$1,598	86.54	$1,598
IMPROVED	0.00	$0	54.49	$1,006	54.49	$1,006
SAVINGS	0.00	$0	32.05	$592	32.05	$592
OTHER SAVINGS	0.00	$0	0.00	$3,077	0.00	$3,077
TOTAL SAVINGS	0.00	$0	32.05	$3,669	32.05	$3,669

SAVINGS - INVESTMENT RATIO (SIR):

PER ATTACHED LCC ANALYSIS 1.65

SIMPLE PAYBACK PERIOD:

TOTAL INVESTMENT/ANNUAL SAVINGS

$25,450 / $3,669 /YR = 6.9 YRS

LOCATION: KUNIA FIELD STATION, HAWAII

SCOPE: REPLACE INCANDESCENT FIXTURES W/ HPS ALONG PERIMETER FENCE

ITEM	DESCRIPTION	EXISTING	NEW
A.	FIXTURE DATE:		
	FIXTURE/LAMP TYPE	3-45W/PAR-38	1-70W/HPS
	NO. OF FIXTURES	43	43
	NO. OF LAMPS/FIXTURE	3	1
	LUMENS/LAMP	1800	5800
	WATTS/LAMP	45	70
	WATTS/FIXTURE	135	85
	LAMP LIFE (HRS)	2000	24000
B.	INSTALLATION COST:		
	MATERIAL UNIT COST	NA	385
	TOTAL MATERIAL COST		16534
	LABOR UNIT COST		195
	TOTAL LABOR COST		8380
	TOTAL COST	↓	24914
C.	OPERATION & MAINTENANCE:		
	RELAMPING MATERIAL COST/FIXTURE	22.50	41.90
	BASE RELAMPING LABOR MH/FIXTURE	.75	.75
	RELAMPING LABOR COST/FIXTURE	15	15
	HRS USE PER YEAR	4368	4368
	ENERGY USE PER YEAR (KWH)	25356	15965
	MAINTENANCE COST/YEAR	3522	445
D.	ECONOMIC ANALYSIS:		
	ENERGY SAVINGS/YEAR (KWH)	NA	9391
	ENERGY SAVINGS/YEAR (MBTU) (KWH X .003413 MBTU/KWH)		32.05
	ENERGY SAVINGS/YEAR ($)		592
	MAINTENANCE COST SAVINGS/YEAR		3077
	TOTAL SAVINGS/YEAR	↓	3669

ENERGY ENGINEERING ANALYSIS - LIGHTING PROFILE

INSTALLATION: U.S. ARMY FIELD STATION
LOCATION: KUNIA, HAWAII
AREA: PERIMETER FENCE
ECO NAME: REPLACE INCANDESCENT FIXTURES W/ HPS ALONG PERIMETER FENCE
CONDITION: IMPROVED
MAXIMUM LIGHTING LOAD: 9.5 KW

	FRACTION OF MAXIMUM (0.0 - 1.00)							
HOUR	SUN	MON	TUE	WED	THU	FRI	SAT	HOLIDAY
1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2								
3								
4								
5								
6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
19	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
20								
21								
22								
23								
24								
TOTAL	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0

TOTAL PER UNIT KW HOUR/WEEK 84 HRS/WK
TOTAL PER UNIT KW HOUR/YEAR 4,368 HRS/YR

COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

INVITATION/CONTRACTOR:

EFFECTIVE PRICING DATE:

DATE PREPARED: 4-29-88

PROJECT: REPLACE INCANDESCENT FIXTURES W/ HPS ALONG PERIMETER FENCE

LOCATION: KUNIA FIELD STATION, HAWAII

CODE (Check one): [X] A [ ] B [ ] C [ ] OTHER

DRAWING NO.:

SHEET | OF | SHEETS

ESTIMATOR: AY

CHECKED BY: GO

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
REMOVE INCAND LT	43	EA	0.5	21.5	45	968			—		968		
HPS LT FIXT	43	EA	2	86	45	3870			300	12,900	16770		
MISC WORK	1	LS									1700		
SUBTOTAL											19438		
PROFIT, OH, TAX, BOND (28.1%)											5476		
										TOTAL #	24914		
TOTAL THIS SHEET													

DA FORM 5418-R, [illegible] 86

B-82

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	KUNIA,HAWAII	REGION NO.:	9
PROJECT TITLE:	EEAP/KUNIA	PROJECT NO.:	
DISCRETE PORTION NAME:	REPLACE INCAND W/HPS AT PERIMETER FENCE	FISCAL YEAR:	1988
		ANALYSIS DATE:	MAY 1988
PREPARED BY: R.M. TOWILL CORPORATION		ECONOMIC LIFE IN YRS:	25

1. INVESTMENT

A. CONSTRUCTION COST		$24,914	
B. SIOH	7.5% OF 1A	$1,869	
C. DESIGN COST	6.0% OF 1A	$1,495	
D. ENERGY CREDIT CALC	((1A+1B+1C) X 0.9)	$25,450	
E. SALVAGE VALUE		$0	
F. TOTAL INVESTMENT	(1D - 1E)		$25,450

2. ENERGY SAVINGS (+) / COSTS (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST, AND DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELEC	18.46	32.05	591.64	10.42	$6,165	
B. OIL	5.91	0.00	0.00	16.70	$0	
C.						
D. TOTAL		32.05	591.64			$6,165

3. NON ENERGY SAVINGS (+) / COSTS (-)

A. ANNUAL RECURRING (+/-)		3077.00	
(1) DISCOUNT FACTOR		11.65	
(2) DISCOUNTED SAVINGS(+)/COST(-)	(3A X 3A1)	35847.05	

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS(+) COSTS(-) (1)	YEAR OF OCCURENCE (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAVINGS(+)/COSTS(-) (4)
a.	0	0	0	0
b.	0			0
c.	0			0
d. TOTAL	0			0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS(+)/COSTS(-) (3A2+3Bd4)	$	35,847

D. PROJECT NON-ENERGY QUALIFICATION TEST

(1) 25% MAX NON-ENERGY CALC (2D5 X .33)	$2,034	
(a) IF 3D1 IS = OR > 3C GO TO ITEM 4		
(b) IF 3D1 IS < 3C CALC SIR=(2D5+3D1)/1F	0.32	
(c) IF 3D1b IS = OR > 1.0 GO TO ITEM 4		
(d) IF 3D1b IS < 1.0 PROJECT DOES NOT QUALIFY	NA	

4. FIRST YEAR DOLLAR SAVINGS (2D3+3A+(3B1d/ECONOMIC LIFE))	$3,669
5. TOTAL NET DISCOUNTED SAVINGS/COST (2D5+3C)	$42,012
6. DISCOUNTED SAVINGS RATIO (SIR)=((5.)/1F)=	1.65